UNIVERSITY OF WINCHESTER

Writing genetic science-inspired fiction in contemporary society

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Doctor of Philosophy

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ABSTRACT

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Through an informed exercise in creating and writing original fiction about characters and issues involved in contemporary and near-future science, this practice-based thesis examines how the representation of scientific knowledge can be critically explored through creative writing and fiction grounded in science, specifically genetic science. The creative element of this research is presented as a themed or linked collection of genetic science-inspired speculative fiction in the form of two novelettes and one novella. These collected works present opportunities to explore scientific, ethical and moral issues within the area of contemporary-facing genetic science through fiction. The activity of engaging with science and science-related characters via an empirical investigation is explored within each individual creative piece.

As objects of creative production, these works offer both the experience of engaging with science-related characters as they pursue scientific (and personal) goals, and an opportunity to explore a variety of implications and possibilities of (genetic) science in contemporary society. This approach allows investigation through a range of methods to examine a creative process from a critical perspective using practice-as-research (PaR) methodology. Individually, a close-examination and commentary is offered on the interaction between storyline, science elements, characters and characterisations. Through this exploration a critical analysis is delivered on the influence of science in the design and writing of the fiction collection.

With the completion of the creative and critical elements of this thesis, a research study rooted as much in process as on focused outcome is established. The creative practice is seen to critically inform how a factually inspired genetic science work of fiction is delivered and as such, the thesis introduces a model that can be applied by other academics and practitioners working within the fields of contemporary fiction and science.

Keywords: creative writing, fiction, speculative, genetic science, practice-based, PaR, intertextuality, science-as-fiction, science communication, two-cultures

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INTRODUCTION

In this research study I examine how the representation of scientific knowledge can be explored through creative discourse, proposed here through my writing of original fiction. In employing a practice-based approach to this research study, I have written a creative collection of genetic science-inspired speculative fiction in the form of two novelettes and a novella. This creative work is presented as a themed or linked collection of fiction: two novelettes ('The Commuter Lab' and 'The Patient Experiment'), and one novella ('A Common Thread')[1]. This thematic collection of content-linked pieces is intended to present readers with a thought-provoking experience, whilst offering the opportunity to explore scientific, ethical and moral issues within the area of contemporary-facing genetic science. My writing offers a chance to examine up-close aspects of scientific and genetic laboratory practice, through original fiction. The activity of science (specifically genetics) and the generic processes associated with engaging in an empirical investigation are explored as constituent elements of the individual works. Through the writing of contemporary speculative fiction, I present these as familiar, recognisable and relevant environments.

I chose genetic science[2] for my research study rather than a generalised topic of science for two main reasons. Firstly, driven from a mix of personal interest and professional concern, the rapidly developing nature of genetic science means it is a fertile ground for contemporary characters, situations and storylines. And secondly, in my research I conclude that there is a high potential for producing research practice that has contemporary relevance, as developmental genetic science and technology increasingly impacts on individual lives. The enterprise of genetic science, specifically those activities associated with areas of engineering, technology and human medical research, offer many possibilities for creative story ideas. The subject-specific content offered by the science of genetics and genetic engineering proved to be the most appropriate foundation for my practice collection, as I found it consistently topical and very much an integral part of twenty-first century living. This combination provided an opportunity to produce a body of relevant and dynamic work, written about and aimed at, a contemporary society.

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[1] In the drafting stages of my fictions they allocated an alpha-numerical tag alongside their title: this is the order in which they were first written and the order in which they are presented to be read in the collection. This is as follows: 'The Commuter Lab' (CWP1); 'The Patient Experiment' (CWP2), and 'A Common Thread' (CWP3).

[2] A succinct introduction to the field of genetic science is provided by *New Scientist* writer Philip Cohen. He says that genetics is '…the study of how our physical and behavioural traits are inherited' (2006, p.1).

CREATIVE PRACTICE COLLECTION

Introducing the collection

The three pieces of speculative fiction that combine to make this collection should be considered as both individual pieces whilst also collectively contributing to a contemporary linked collection of science-inspired fiction. As detailed in the main thesis 'Introduction', my creative works are linked not only through the themes and subject matter of genetic science but also the make-up (and position) of the central characters and their approach to how, why and what scientific concepts, theories and practical processes are employed throughout.

This linked collection centres on characters who are involved in the undertaking (or processes) of science and genetic science in a contemporary setting. The portrayal of empirical genetic science and its workings are designed to lend an increasing familiarity to the reader as they move through the collection. The scientific processes are fore-fronted in the earlier pieces and so this acquired knowledge can be built-up, to be called upon through lighter references and exposition in the latter pieces. It is hoped that as the individual works are progressed through (in sequence) the acquired knowledge will help to open up these pieces to wider ideas, interpretations and contexts, as to how the science of genetics (and resultant technology) is having, and undoubtedly will have, a profound impact on the lives of present and future generations.

On a personal note, I am aware of the seemingly unorthodox approach I have employed in creating and constructing my fiction for this collection/study, and that it may lead some readers to (fairly) question my methods and end results. My intention was always to create fictions (and integral characters) that would be entertaining and informative in helping to familiarise a reader with some of the processes of science and genetic science, and in this method expose a wider audience to some of those overarching ideas, debates and discussions. It is this ambition to get people talking and thinking constructively about the areas of science that have huge impacts on both individuals and in society, that led me to utilise a mix of contemporary and speculative fiction, as it is the approach I thought most suited the content.

Two literary events that happened in 2017 struck a chord with me regarding the development of this practice collection and the thesis as a whole: Ishiguro winning the Nobel Prize in Literature and George Saunders winning the Man Booker Prize. These writers share approaches to their craft that cut across both the conventional divide between genre and

literary fiction and—more so in relation to my own practice—the divides between fiction, science fiction, fantasy fiction and speculative fiction. I take inspiration from this.

‘The Commuter Lab’

The Commuter Lab

RANDALL leant awkwardly on a pavement-side barrier outside of Holborn tube station. He browsed *The London Metro*. Amongst the chaos and white noise of the late morning commute, no-one in the constantly moving mass paid him the slightest bit of attention. Outside of his laboratory Professor Randall appeared as just another well-dressed summer eccentric in his early sixties. There was no white coat to alarm or impress. Perhaps they should have looked a little closer.

Stressed commuters offered rehearsed politeness as east-bound workers struggled to wade across lines of those headed south for the Aldwych. Positioned in the centre was a forlorn-looking chugger.

'Morning sir?' 'Morning madam?' 'Would you be able to spare a couple of minutes?' 'No?' 'Would you believe that I've got two, yes two science degrees then?' 'Still no?' 'How about if I said that I know what I'm talking about when I say that this is really important?' 'Still no?' 'Okay. Thank you.' 'You have a good day.' Enjoy it while you still can. Peter knew he was destined never to get rich on commission. I wonder if they can tell my heart's not really in this, he thought. Peter looked for a likely victim. His attention was fleetingly caught by an immobile man in a panama hat. I'll save that one for later. He hurried after a mature lady in a lengthy movement-restricting skirt. 'Excuse me madam. Do you have a few minutes to spare for a good cause? Believe me I'm a scientist, I know what I'm talking about...'

It was mid-August and Kingsway, Holborn's dualled thoroughfare shimmered with rising exhaust gasses. Randall kept his exposed skin to a minimum. From Panama hat to desert boots he seemed to be covered. Only on closer inspection would some of his visible accessories cause a casual observer concern. Even in central London it was not every day that you saw a middle-aged commuter wearing skin-coloured latex gloves, a swimmer's transparent nose clip and a mini face mask covering just his lips. Not all at the same time anyway.

Randall looked up from the paper and glanced over his shoulder. Behind his back a sea of commuters dotted with a handful of London underground staff and a pale-looking flame-haired chugger formed the Holborn morning swell. He folded the paper and effortlessly pushed himself away from the barrier. Like a swimmer joining the pool's fast lane, he merged into the mass unnoticed.

If I can't get a signature from someone who can hardly move then it's going to be another long pointless day, Peter thought after his quarry had given him the slip. He looked over at the near-stationary traffic. And that soft target's gone now too. Bollocks. Just my luck. 'C'mon keep it together there Pete,' he said quietly. 'Bel has faith that it will get better. But I really fucking hate this. Keep a lid on it. Remember, you promised her that your anger was under control. Bel won't be there this time to bail you out and pick you up. Remember that. I know, I know.'

At the far end of the pavement Randall moved around in a seemingly prepared circuit outside the tube's main entrances. Each time he stopped a clinical routine was followed. He unfolded the newspaper, glanced over its pages, carefully removed a small device and collected up samples. Inside this grey moulded plastic tube was a small suction motor and a sealed collection chamber. To the casual observer it looked just like a medical inhaler. Before each pass Randall took a single deep breath. Whatever he was collecting it seemed to have contaminated everything. It was on railings, wall-mounted underground maps, pedestrian crossing control panels and waste containers. At the end of each collection Randall exhaled, placed the device back in his jacket pocket and casually returned to the paper. After a couple of minutes he moved onto the next spot and began to gather again.

In danger of disappearing into a dark place, Peter's thoughts turned to coffee. He did not need much persuasion and headed in to the station foyer.

'Morning Junior.' Peter waited for any sort of reply. 'Busy?'

A teenage boy tall but thin hiding under an over-sized baseball cap, stared at him expressionless from inside the *Kaffee Kiosk*. Eventually a left eyebrow raised just a fraction.

'Good. Glad to hear it,' Peter replied. 'The usual please.' He placed some coins in a small flat tray on the counter top.

The left eyebrow raised again, ever so slightly.

Peter watched as Junior scratched "DSMacc" in a small notepad. He presumed this was to be his double-shot macchiato.

As he stepped away from the counter Peter looked out into the randomness of commuter-land. If only there was a scientific way of calculating who was likely to stop and listen it would make life easier. And more profitable, he thought.

'Double macc,' bellowed a high-pitched scouse accent from within the kiosk.

Peter wheeled around and left his daydreams behind. 'Thanks Lou. That's for me.'

A silvery-blonde head bobbed up from below the counter. ‘Junior why didn’t you say it was for Pete?’ The blonde head turned to face him. ‘Kids eh,’ Lou said. ‘Do you wanna biscotti or two with that?’

‘Go on then.’ Peter grinned.

Lou ducked down under the counter top and came back up with four shrink-wrapped packets and handed them over.

‘This should keep you going. Don’t scoff ‘em all at once.’

‘You’re a star Lou.’

‘Well I’ve been there haven’t I. Ten years flogging *The Big Issue* gives a person perspective on things. You appreciate the small touches. You appreciate not feeling alone, abandoned. Know what I mean?’ Lou asked, his full rosy cheeks dripped with a mixture of sweat and steam. He wiped his face dry with a small towel and remembered. Just for a second or two.

‘Exactly.’ Peter nodded.

Junior handed over a pile of orders to his father.

Lou looked at them and smiled. ‘Never stops. Just the way I like it.’ He disappeared back under the counter.

One day I must have a look in there. ‘See you later Lou.’

‘Later La’,’ came the curtailed response amongst the release of pressurised steam.

Peter collected his coffee. Junior raised an eyebrow. He gestured back. That lad’s definitely getting chattier. He left the station foyer to enjoy a moment of peace inside the maelstrom.

As Peter sipped he observed the Panama hat resurface. Bit over-dressed, he thought. He watched the hat move from place to place mostly against the flow of the commuter traffic. You’re not all you seem are you? Peter ditched his paper cup onto one of the piles of rubbish which collected around the temporary waste bins. What’s he up to? Peter moved closer to the eccentric in the expensive straw hat.

Panama’s undertaking a field experiment. Peter stopped himself short from saying it out loud. He could recognise one after spending four years conducting them himself. Peter decided that whatever charity he was supposed to be collecting for that day could wait just a bit longer for their “golden egg”. He opted to give his extensive knowledge of biological field studies an airing. Any thoughts of his work such as it was, disappeared. The dog had seen the rabbit. The boredom and pointlessness Peter felt in this job (and by extension his life) resolved into a clear view. This is exciting. I’m actually interested in something that I know about, and it isn’t this shitty job. At a respectful distance Peter followed Panama in his quickstep through the hurly-burly world of the commuter.

Across the crowd the professor was unaware he was being stalked.

The science postgrad watched his quarry's actions carefully and soon felt he had a good idea what he was up to. This certainly beats trying to collect money from people who just don't want to part with it. I'd be great at this type of covert fieldwork, he reflected, tracking the Panama hat all the time.

In between collections Randall looked out across the fluid reservoir of commuters heading in every direction. He was engrossed in his work but mindful also not to draw any lasting unwanted attention.

Peter was sure he had been spotted but the man in the Panama looked straight through him. That was close. It's no good I'm going to have to approach him, Peter resolved. I'm fed up with waiting for things to happen for me. I'm just going to ask what he's doing, as I'd be perfect for that job. You never know, this might be the opportunity I've been waiting for. Peter waited for Panama to return to his collecting and approached him.

'You seem busy sir but would you like to make a real difference today?' Peter enquired from behind the man.

Randall, whose attention was focussed on his sampling, jumped at the unexpected interruption. 'What!' He pulled off his mask and nose clip in a practised manner. He turned around, deftly pocketing the small vacuum device. Unaware of how close Peter was, he unintentionally knocked him off his feet. Peter stumbled over but quickly regained his footing.

'So sorry. Oh. You're one of those...'

'"Charity fundraiser"? Yes sir, I am. And one that you've just assaulted.'

'That was an accident and I've apologised. Whatever you're selling I'm not interested. Please go and bother someone else,' Randall said calmly.

'That's not very polite sir. No matter. I couldn't help notice that you seem to have lost something?'

'What are you wittering on about? "Lost something"?' Randall countered.

'With all your wanderings about I thought you must have dropped something?' Peter asked.

Randall's grip tightened on the pocketed device. 'Don't waste my time. Go on. On your way.' Randall turned his back.

A link snapped inside of Peter. The kind that holds normalcy together: connecting thought and rational behaviour to actions. Whether this was due to a pent-up frustration, the pressure of dealing with people who treated you like a non-person or perhaps it was just the arrogance of this particular individual coupled together with the accidental assault, a chain reaction had begun. Fuelled by Panama's dismissive and aggressive nature an episode of fleeting madness was triggered.

'I've been watching you. What have you got there?'

Peter made a grab for the man's pocket. Partly out of frustration and partly, he thought, to teach this arrogant git a lesson. In this moment all rational thought deserted the charity fundraiser.

Randall dropped the paper and forcibly parried Peter's grabbing attempt with his free hand.

Peter let out a stifled moan. 'Hey! What the feck? What you hiding in there?'

'Try that again and I'll break it.'

A scuffle ensued. As Peter's Celtic temper broke Randall's seemed to hold. Peter tried to wrestle the device free.

Disembodied comments punctuated the skirmish. 'Is it some sort of street performance?' 'My money's on the Hat.' 'Do you think we should stop them?' A reluctant crowd gathered as commuters tried in vain to find a way around.

'Hey. Hey. What's happening here?' A robust uniformed London Underground official pushed his way through to the brawling pair. 'C'mon break it up you two. You're both old enough to know better. I've already called it in and the transport police will be here any minute,' he said half-heartedly.

At the mention of the authorities becoming involved Randall stopped. Peter seemed lost in a fit of temper and carried on with his struggle to liberate the device.

'What are you all staring at? There's nothing going on here. Just a misunderstanding. Move on please. Move on.' The LU official tried to disperse the swelling crowd with little success.

For a split-second Randall seemed to stop and stare at individual faces in the crowd.

If I can just force his hand out somehow I can grab it off him, Peter thought. He sought to take advantage of his foe's lapse in concentration.

‘C’mon move on please,’ the official tried again with a little more conviction in his voice. He stretched his arms out to move them on as though he were trying to herd cats.

With one huge effort Peter managed to prise Randall’s hand out from his pocket. In the jostling mayhem the device fell to the floor. Randall made a grab for it with his left hand but instead tore off Peter’s breast pocket. The crowd looked mildly engaged in this new development. A few hands reached out for the object.

‘Don’t touch that.’ Randall swept the device out of the crowd’s reach and managed to get a finger-hold on it. His hat became dislodged and disappeared into the mass as he sprawled on the pavement.

With a determined last effort Peter reached up and snatched the device. He rolled out of the melee and was quick to his feet. ‘Thanks. I think I’ll be taking this,’ Peter imparted as he sprinted away heading south down Kingsway.

Randall, the LU official and members of the rapidly dispersing crowd looked on bewildered.

‘Go ‘ead Lad,’ a high-pitched voice shouted from the edges of the crowd. This sparked a few murmurings of agreement and disagreement amongst them.

A few seconds later Randall made a swift exit out into the crowded streets of High Holborn clutching the torn pocket. The lines of commuters parted briefly and swallowed him up in their relentless throng.

*

On the westbound platform of St. Paul’s underground station Peter’s heart raced. He had managed fright, fight and flight all in one intense period. Stale hot air washed down the platform as a tube train bound for Ealing Broadway arrived. Peter watched the doors slide open. He waited. As they started to close he jumped forward and squeezed his way through into the carriage.

Once seated Peter reached into his jacket and pulled out the device. He examined it. God. Was it worth it? He shook his head. He slipped it into his back pocket away from curious eyes. It was only then Peter noticed the hole where his breast pocket used to be. He felt his stomach drop.

‘Bollocks! My jacket. My ID?’ he blurted out.

His fellow travellers inched away. Peter took out his phone and wallet from the jacket and stuffed them into the front pockets of his faded black combats.

The tube train's next stop was Chancery Lane. Peter watched his fellow travellers disembark. Alone at last. As the train continued on its westerly journey he took off his torn jacket fearing he might be recognised from the earlier fracas, balled it up tight and wedged it under a seat. 'What now?' he asked himself.

Peter walked down the carriage until he found a legible underground map. Where to? he wondered. As he stared at the multi-coloured lines the thread of an idea came to him. 'TT,' he said. 'I'm sure him and his G^3 DNA-hacking pals will be able to figure this one out.' Peter smiled.

*

The professor preferred to travel on foot. After passing Old Street station he turned up an alleyway into Lizard Street and approached a plain dark doorway. He punched in a code. Once through there was a second keypad controlled door. He could see an empty reception area through smoked glass. As he entered the reception area the professor felt himself relax. He hung up his jacket and looked around. 'Dr. Hawkes...Miss Avelyne? Is anyone here?'

"Bang." Somewhere in the building a door slammed closed. Randall looked up. Sounds of a conversation drifted down the stairwell.

'Miss Avelyne?' Distant footsteps sounded on the staircase. The rhythm was quick and even. They grew louder as the professor waited.

'Professor Randall! We weren't expecting you back so soon. I had to take some results up to Dr. Hawkes,' Miss Avelyne said as she looped a strand of dark hair behind an ear.

'That's okay Amy. I'm afraid we need to deal with a potential situation straightaway,' Randall said. He had a slight edge to his voice.

'Situation?' What's happened this time, she thought.

'An interfering civvie,' he replied. 'I was finishing up with the final "bio-sweep", then out of the crowd this...chugger tries to steal the vacuum unit after I accidentally knocked him over. We get into a scuffle. The underground staff become interested in the unit. This youth makes a lucky grab for it. He succeeds and runs off into the backstreets.'

'Did you go after him?' Amy asked. What a bloody idiot. I've warned him about the possibility of this.

'No. I thought it best not to.'

At least that's the one decision you did get right today. Amy suppressed her anger.

'Although I did get this...' Randall handed her the torn pocket and name badge. 'Could you run it through your various databases and see what sticks?'

Amy took the ID. ‘Seems genuine enough. Shouldn’t be a problem. I’ll have a track on this “Peter McAvoy” before he can cause us any trouble. Probably just some kid who got carried away,’ she added in an effort to placate the professor.

‘I’m not overly concerned about what happens to him. What we don’t want is someone presenting to an A&E after being exposed to a concentrated dose of the sample. That could bring the sort of attention we can all do without.’

Amy nodded. Considerate as always.

‘Can you update Dr. Hawkes and let him know what’s going on,’ Randall added. He headed off along the ground-floor corridor. Without breaking stride he called back, ‘I’ll join you and Dr. Hawkes in his lab shortly. Thanks Amy.’

She shook her head and walked across to a room behind the reception area. For Amy this was her domain. From the security control room she could monitor who and what came in and out of the building whatever form it took. Not exactly what I had planned for today. Amy sat down. ‘Okay Peter, let’s see if I should be concerned.’ She set to work.

*

As he travelled north out of the city Peter reflected on events. Even the antiquated mis-matched track points through Arnos Grove had failed to jolt him out of the rising panic he felt. He gripped the device tight.

‘Cockfosters. Cockfosters. End of the line. Please leave the train. Please leave the train,’ chanted a royal blue-uniformed tube driver in a lyrical meter, as he strolled down the platform.

The rhythmic pattern stirred Peter.

The driver looked in at the pale worried-looking passenger who had outstayed his welcome. He stepped onto the train. ‘You okay son? We’ve just pulled into Cockfosters. End of the line. Sorry but you need to get off.’ The driver kept his distance.

Peter looked up, checked the vacuum device again in his trouser pocket and relaxed a touch. He smiled weakly, got to his feet and headed toward the open double doors.

The driver re-joined the platform and continued his mantra as he moved on to check the remainder of the train.

Standing on the platform Peter sucked in a deep breath. He exhaled. Clean air. It felt good. Once through the ticket barrier he turned left out of the main station and down towards Cat Hill.

*

Amy sat in front of two widescreen monitors, speaking into a wireless headset, ‘...one hint of this in the press and at best we’re on our own. At worst is anyone’s guess.’

She listened to her caller’s reply.

‘The field work was always going to be a security risk.’

Amy listened again patiently, then said, ‘Of course I had assessed that possibility. There’s only a limited number of ways you can effectively explain away the effects of an accidental release.’

After a short reply Amy added, ‘Don’t be so sure. You wouldn’t believe the private details you can find out from Facebook let alone the so-called dark web. They’ve got no concept of personal space.’

Amy nodded at her caller’s reply.

‘Anyway Simon, as soon as I’ve updated the professor I’ll see you in the lab.’ She disconnected the call to Dr. Hawkes.

Amy maximised the information on McAvoy across both screens in order to collate it. She had gathered and data-mined it through a range of publicly available and privileged online sites. From across open-access databases, encrypted servers and “back-door” sources including NHS records, Amy had assembled McAvoy’s profile. In addition she used information harvested from a Security Services-sponsored gaming app, “Nought y Cross” designed to hack into Facebook log-in pages and siphon off personal data. This was always a bonus.

She looked at the information before her and saw Peter McAvoy’s whole life history: decent state school results, BSc and MSc degrees, stable family… It makes you wonder what happens to people like you, Peter. What are your goals, what’s your career path, what are you doing with your life? Ah, here we go: in trouble with the authorities. Just a small issue. Unfortunately for you, this time it’s a much bigger deal. She shook her head at the ease of hacking someone’s life. If these people invest so little time in protecting their own details they get everything they deserve.

Amy captured the display as a screenshot, emailed the attachment to Randall and printed off hard copies. She paged him and waited for a connection.

‘Hello, Professor. You should have just received the information on our little chugger friend McAvoy.’

‘A scientist nonetheless. A two-two in Biology from Middlesex along with a recently completed Masters in Bio-engineering at QM.’

Amy listened as Randall summarised her findings. Yes I know all of this already. She waited for him to finish.

‘It seems as though he has links to G^3. Your personal bête-noir bunch of amateur genome hackers,’ she offered. Amy waited for Randall to comment. He stayed silent. ‘This *attack* might not be as random as it first appears. This is only speculation but it could be something more co-ordinated,’ she finished.

It was a short time before Randall replied to her comments. She noted down some of his requests.

'I'll bring them up to the lab Professor. I've already sent a copy through to Dr. Hawkes to have a look at.' Amy disconnected the line and removed her headset. She gathered the printed sheets and headed out onto the stairwell.

*

Amy pushed open the outer lab door and walked into a secure air-locked space. She waited for this to seal itself and then entered through into an impressive gothic Victorian loft. Housed inside was the ultra-modern laboratory which served as their centre of operations.

Dr. Simon Hawkes, a slim bespectacled early middle-aged man, sat crouched over a stainless steel test bench. Alongside him was a tidy array of gleaming pearlescent white machinery. Dr. Hawkes was dressed smartly in a lightweight dark suit. Draped over the back of his chair was a neatly pressed white lab coat. The bench occupied one isolated corner of the vast loft room. Opposite this sat a large ornate Victorian oak dining table and chairs.

Dr. Hawkes briefly lifted his head to acknowledge Amy's presence.

She approached the test bench. 'Simon,' she responded.

'No sign of the professor yet?' Dr. Hawkes asked without looking up.

'On his way.' Amy moved closer to within intimate distance. 'How's the new analyser coping with the data?'

'Remarkably well. London's unofficial population of fungal spores is keeping us all busy.' Dr. Hawkes affectionately patted a white box of highly calibrated electronic trickery in front of him.

'If he keeps releasing and harvesting at this rate we'll be exposing a new variant to the City each day.'

Dr. Hawkes shrugged. 'Most of it is still at the prototype stage and these samples are still fairly benign. Anyway this cycle's nearing conclusion.'

Amy's face expressed reservation. 'Some of those spores are quite reactive though.'

'There's always risk. And you do a great job in minimising it.'

She stepped back from him and turned away. 'Ignore me. I was just thinking out loud.'

'Look, I understand. Even from your own assessments the concentrated exposure would have to be thousands of times the levels we're currently exposing the population to,' Dr. Hawkes replied.

'Perhaps,' but I'm not the only one who needs reassuring, Amy thought. She decided to let it go.

Amy walked over to the dining table. It was set beneath a line of leaded Victorian window lights. The late afternoon summer sun shone through to cast a soft warm hue over much of the loft. The gentle glow did not quite reach to where the doctor sat.

'Any more on this McAvoy bloke?' Dr. Hawkes asked across the room.

Amy let a few seconds pass by. 'Not had a chance to look at your email then I guess?'

'Nope.'

'You surprise me. No one ever does,' she said. 'I've got it all here,' Amy waved the bundle of papers she carried. 'I'll run through it when the professor arrives.'

Dr. Hawkes stood up and walked towards her. 'He'll be ages yet, let's have a look while we wait?'

Amy stared at him. There's a good boy Simon. She held out one of the copies.

He browsed through it. 'Doesn't look like a troublemaker? Seems harmless enough. Even with any tenuous links to the so-called "Garage Genome Group", it's a stretch to start imagining conspiracy theories,' he said. 'G^3: didn't the professor have that run-in with them a couple of years back?' he asked.

Amy refused to take the bait.

The inner door opened and Professor Randall walked through to join them.

Amy headed over and handed him a copy of the print out.

Randall took the pages and quickly scoured them. He motioned to the dining table.

Once they were all seated, the professor began. 'To the matter-in-hand. How to minimise our potential risk with maximum efficiency and speed. Our main priority should be to prevent McAvoy's actions jeopardising our research programme. Secondly and particularly over the next few hours, try to stop him from infecting himself along with any other of the half-wits he may have already contacted.'

Amy looked at Dr. Hawkes' reaction as the professor spoke.

'All ideas welcome,' Randall concluded. 'Amy, would you like to start? After all this is your department.'

*

Peter walked along the Cockfosters Road. The pavements were busy with all sorts of pedestrian traffic. He looked at his watch. Lunchtime. He pushed through the steady stream of customers filing in and out of the numerous bakeries and delis. He felt hungry.

Peter stopped in front of a particularly garish patisserie. He entered a stairwell to the right of the cake shop. It read, "Heddon Court: 1A-6A". He climbed up a single flight of granite steps to the apartments. Peter rapped twice on the wooden door of 1A. He watched through a circular frame of sunburst stained glass as coloured shapes moved inside the hallway. I hope

he's still here. The door opened slowly. He was greeted by an unshaven bespectacled face. Initial hesitance was replaced by a wide smile. This immediately settled Peter's nerves. Topped by unkempt dark hair the smiling face belonged to his old friend Thomas Taylor, known to most as "TT".

'Peter McAvoy! Great to see you. Not mugging anyone for charity today? What is it for this month? "Save the Mammoth's gene pool"?' TT said.

'Ha bloody ha! You going to invite me in or what? How's the burger trade going Tom or are you still impersonating a motorbike festival?' Peter pushed past him and into the hallway.

'TT is still good and the gourmet burger trade is doing well my friend.' He stepped out of Peter's wake and closed the door. 'But the late night shift is killing me. Who'd have thought four years' of studying biology would have led us to our current states of employ?'

Peter shook him by the shoulder in a welcoming gesture and headed towards the kitchen door. 'I think I may have a serious problem.'

'Qualify *serious*?' TT asked.

'You still involved with that bunch of half-arsed bio-hackers?'

'Garage Genome Hackers? Of course. G^3 continues to de-bunk the myth of modern geneticist. "Boldly splicing where no geneticist has spliced before". And we're not that half-arsed.'

Peter pulled a pained expression.

'Why? What's up?'

'I may have been a bit reckless and done something incredibly stupid. I don't honestly know what came over me,' Peter looked troubled. 'I could genuinely do with your help.'

On hearing Peter's sombre tone, TT seemed to change gear and moved toward the kitchen with purpose. 'Sounds intense. Let's get some tea brewing and you can tell me all about it.'

Peter smiled and remembered why he liked TT so much. He knew his old friend could act the fool but his leftfield approach to ethical genetic engineering had proved inspirational to both fellow students and academics alike.

*

High above the City of London's streets Amy, Professor Randall and Dr. Hawkes sat and deliberated.

'I doubt McAvoy could make any sense of what he's got even with G^3's help. However we still need to try and recover what is in that device,' Randall said.

'Surely he's not worth wasting our time on? We could go out later and repeat a shortened run of the collection. There are at least fifteen hours left before the material degrades. No-one would notice us during the evening rush hour,' Dr. Hawkes offered.

‘Dr. Hawkes is right. There’s only the three of us here. We’re better off concentrating on the main work for this phase. The collection and interpretation of the data,’ Amy said.

Randall looked up at Dr. Hawkes. ‘I had already considered that. I will be heading out shortly.’

‘That’s that sorted then,’ Amy replied.

‘Not quite. I’d still like the micro-vacuum back. We can’t risk McAvoy or G^3 exposing that concentration of material to laboratory investigations or extreme environments. God only knows what Taylor and his cronies are up to these days,’ Randall stated.

‘Very few commercial laboratories have the ability to work safely in a closed-system environment involving the levels of heat and pressure we’re talking about. What makes you think G^3 have that capability?’ Dr. Hawkes asked.

‘Experience. A hunch. Call it what you will but Taylor has made a virtue out of wrong-footing the scientific establishment.’

‘Okay. We can pass this onto our friendly security handler,’ Dr. Hawkes replied. ‘They still have a debt to clear after we took care of that fiasco with the live bio-weapons exercise out on the Isle of Grain.’

‘Are your friends in the Met still willing to assist us Amy?’ Randall asked.

‘They’ve not got much choice within reason, have they?’ Neither do I now. Thanks Simon. You’re such a git sometimes. ‘Why? What were you proposing?’

‘Just a couple of low-profile home visits. Cockfosters for TT. East Dulwich for McAvoy,’ said Dr. Hawkes.

‘If we use them on this then that will be it. No more favours. The help we gave them cleaning up that temporary nerve agent would be repaid in full.’ Amy looked to the professor. ‘Okay. What would you want them to do?’

‘Recovery first and foremost. Perhaps tied in with a friendly warning? I think this would be worth cancelling that debt for.’

‘I can appreciate that Professor. However all it may do is spook them, especially Taylor.’

‘That’s good though. We can flush them out and have them permanently looking over their shoulders. By the time they may have realised what they’ve got, the modified spores in the sample will have perished.’ Randall looked pleased.

Amy considered this scenario for a moment or two. ‘I suppose it makes sense. Fine, I’ll get onto it straightaway and make the necessary calls.’

Randall pushed his seat back and stood up. ‘Good. That’s all settled then. Are you coming downstairs Amy? I’m sure Dr. Hawkes would wish to get on with his analyses. Wouldn’t you Simon?’

*

From within her sanctuary Amy was deep in conversation.

'Yes. Two activists. One in East Dulwich. The other in Cockfosters. I'm just sending over details and recent photo IDs for you now.' Amy executed a few keystrokes and sat back.

Silence.

'Got them?'

She listened to a reply.

'Right. Good hunting. Let me know when you do. Remember the objectives are to frighten them into keeping quiet and above all to retrieve that stolen item. Nothing else is required.'

Amy nodded at the reply.

'When you recover it put the item on one of your bikes to St Luke's immediately. And make sure it is fully security-sealed, air-tight and secure.'

Amy disconnected the line and removed her headset. I wonder what else this day has in store. She returned to the predictability of her data-mining activities.

*

A few hours after the end of their earlier meeting Randall walked by her room and waved. She monitored the CCTV image as he slipped out of the building.

'Please don't screw up this time Professor. Keep tight hold of that collector.' He disappeared from her electronic view. 'I hope I haven't made a mistake issuing you that compact Taser pistol?'

*

In TT's living room Peter replayed his escapade in all its glory. 'He was acting suspicious all along. I could see he was up to no good. I confronted him to get a better look. Then I made a grab for it. He thought he had it. He didn't count on how quick I was. The commuters scattered like frightened sheep. I could hear Lou, the coffee guy who used to sell "The Issue" – you know the one? Anyway I could hear him egging me on. I made one last effort, snatched it away from the "Man" and the underground bloke and legged it.' Peter took a deep breath. 'So here I am.' His tale finished. Quite an adventure, Peter reflected. Just wish it hadn't happened to me.

His friend's only response was to sip tea and record the eventful account on his expensive-looking smartphone. Peter discovered early on in their friendship that TT's appetite for personal technology was insatiable.

'You've no idea who this geezer was? Ever seen him outside Holborn tube before?'

Peter took a swig of his near-tepid tea. 'No idea. But I'd only moved back up from High Street Ken a couple of weeks ago so it was a relatively fresh patch for me.'

‘You should’ve just taken a picture and sent it over. The facial recognition databases we’ve got access to you wouldn’t believe,’ TT said as he sipped.

‘If it’s got to do with you and tech I’d believe anything.’

‘Have you still got the device?’

‘Sorry, yes.’ Peter handed it over. ‘Be careful,’ he added.

TT examined the small grey piece of equipment. He muttered a string of barely audible sounds.

‘So, what do you make of it?’

‘I assumed you’d already figured out? A standard laboratory micro-vacuum unit.’ TT put the device down. ‘You said the guy was using this outside on street furniture?’

‘Yep. Should we open it?’

‘Yes, but not here though. No containment equipment. We’ll take it down the Garage later. I’ve just the right tool for safely analysing whatever’s in here. A brand new microarray. Wait ‘til you see it. It massively speeds up DNA analysis.’

‘Where did that come from? I wouldn’t have thought you can pick one up at the local Maplin?’

‘All the way from those like-minded genome hackers at Stanford,’ TT replied with a double tap of his nose.

TT’s enthusiasm for cutting-edge, non-standard and possibly illegal lab analysis equipment was fairly one-sided. It was not something Peter had ever understood.

‘For now, any guesses on what’s in there?’

‘Apart from dust and carbon particulates the only thing we can be certain is that it contains “Bioweather”.’

‘Bio-what?’

‘You really didn’t pay any attention at Uni did you?’ TT said. ‘All the organic detritus we discard. Skin cells, microbes, germs left on everyday street ware like keypads, door handles, cash points etc.’

‘Oh right. That rubbish. Biocrap!’

‘So much more than “biocrap” as you beautifully put it. The footprint of a community’s existence on a cellular level.’ TT seemed wistful. ‘I take it you still at least browse through the “New Scientist”?’

Peter shrugged. ‘Jobs section count?’

‘Philistine. There’s new research emerging in this field all the time. It speculates that if you know how microbes and pathogens move around a population within a given geographic area

and how the patterns of transmission occur, then you could effectively control the spread of a disease.' TT said.

'What are you talking about?'

'This research wouldn't just be about controlling the spread of disease. It could be about engineering an organism to infiltrate a particular population or social group. Think about it. This could be off the scale.'

Peter reflected on his friend's theories. 'Don't you think you're getting a bit carried away?'

'Who knows?'

'You seriously think this is what "Vacuum Man" could have been up to? Collating data for some covert genetic-mapping exercise?' Peter asked.

TT looked at him and shrugged. He appeared lost in his own thoughts.

Peter shook his head. 'You're barking.'

'Pure genius.' TT jumped up.

A startled Peter looked furtively around the flat.

'That's pure genius that is. I always said you were under-valued with a Desmond.'

'Very kind. But what are you on about?'

'What you just said. Genetic mapping. *Genome Geo-mapping*. Using the bio-trail left on street furniture to establish a pattern of who uses that area.'

'Now you're ranting.'

Peter felt his pocket vibrate. His mobile hummed into life. He fished out the phone and looked at caller ID. "Annabel". 'Annabel?' he mouthed to TT. Wonder what she wants?

This seemed to bring TT back from his mental meanderings. 'Another cup?' He was greeted with a "thumbs up" sign.

'Hi Bel. How're you?'

A high-pitched electronic garble escaped from the tinny speaker.

'Calm down please Bel. I'm alright. Did they show you their police ID? Are you okay?'

TT returned to the living room and hesitated. Peter waved him in.

'Yes. I had an "altercation" this morning,' Peter said. 'And no I'm not hurt.'

Again a high-pitched garble emitted from the mobile's speaker.

'All right! All right Bel. Tell me exactly what they wanted? Did they say they would be coming back?'

As Peter listened the volume of the call settled down.

'Let me think for a moment,' he said. A brief period of silence settled over TT's living room.

‘I still have it yes,’ Peter replied. ‘With TT… Prepaid and off the grid… Okay I’ll call you when we’re somewhere we can be sure is safe.’ He replied in quick succession to Annabel’s questions.

‘You too.’ ‘Bye Bel. Bye.’ Peter tapped his phone and stared blankly at his friend. ‘God. Bollocks. Poor Bel.’ His hands shook. He took a deep breath to try and keep things under control. ‘Did you catch that?’

TT nodded. ‘We’ll relocate to the Garage straightaway. It’s not registered to anyone with connections to myself or G^3. We should be safe there.’ He headed into the hallway. ‘I just need to do a few things first.’

TT collected together his jacket, rucksack, smartphone, trainers and took them into the kitchen.

Peter slipped the micro-vacuum unit back into his pocket. I hope TT knows what he’s doing. He followed his friend.

‘I’ve got a contact. Roger. Do you remember Roger? He was here a few times when you used to be around a bit more?’ TT texted as he talked.

Peter shook his head.

TT carried on with both activities simultaneously. ‘No? He’s a serious communications nerd but a cool guy. Roger despises the notion of any type of state control but he’s caught in a bit of a dilemma. His professional expertise is in surveillance and CCTV system design.’

‘I could see that might be a slight problem,’ Peter said. He felt his initial panic subside. I need to focus on helping TT. He’s probably the only hope I have of getting through this. I’m so sorry Bel. So sorry.

‘My feelings exactly but as Roger says he likes to think “laterally”, whatever that means. Each time he designs a new CCTV system or overhauls one for any publicly funded organisation he builds in an electronic “back-door”. So if he needs to access it at a later date undetected he can.’

‘Fascinating. Is this going to take long only…?’

‘Nearly there,’ TT replied. ‘Recently he’s caused chaos with the traffic management schemes around Central London during the so-called “Protest Days”. He viewed it as levelling the playing field a little.’

‘C’mon get to the point,’ Peter’s voice rose a notch.

TT rolled his eyes. ‘The point being Roger has direct access to the security cameras in and around Holborn tube station. I’ve asked him to retrieve a copy of this morning’s footage from outside the main entrances.’ TT tapped the screen. ‘There. All done.’ He smiled.

‘I always knew I was friends with you for a reason.’

‘Right then.’ TT shouldered his rucksack.

Peter and TT stepped out the kitchen door onto a connecting balcony. Halfway down the fire escape stairwell they heard a distant thumping sound and the tinkle of glass above them. They stopped fleetingly. Looked at each other and moved silently on with added impetus.

*

Amy sketched out possible scenarios. At the desirable end both the device and McAvoy are retrieved. And the unimaginable in which the material is decoded, released to the media and McAvoy protected by proxy. As she mentally paced through what could happen, Amy reflected on possible consequences. Maybe I should run an integrity test on the online security systems? Last thing I need today is some belligerent hacker spoiling for a fight.

A green light flashed on one of the phones in front of Amy.

She switched to speakerphone. ‘Secure line.’

‘Both targets unreachable. Item not recovered. At the SE address contact was made with a co-resident. Status uncertain. Assumed partner.’

‘Go on.’

‘EN target unavailable at supplied address. A discrete sweep of the premises undertaken. Nothing to tie in with reported incident. Clean. Field crew says too clean. Small present left behind. All intelligence will be passed on immediately.’

‘As always we greatly appreciate your help.’ Amy disconnected the call. She tilted her head back and stared into space. Not good. Not good at all. Thanks Professor. This could be a bit more complicated than we anticipated. Okay. Think.

She put on her headset and paged through to Randall’s office. Hopefully you’ll pick this up as soon as you get back whenever that may be. After seven rings a voice recorder took over.

‘Professor. I have just heard back from our friends. Limited success I’m afraid. It may buy us some time with McAvoy. Depends if he is with Taylor or not. As soon as you receive this contact me. Secure sources only please,’ she added.

Amy disconnected the line. Time to get on with those stress tests. If I can’t locate McAvoy or Taylor then I’ll make sure they can’t track us down either.

*

After a drawn out three-legged bus journey Peter and TT ended just half a mile from TT’s flat. They alighted and walked back near to their starting point.

‘TT I know you thought you heard someone breaking in but?’ Peter asked. He looked slightly bewildered.

‘Precautionary principle,’ he replied. TT strode ahead.

Peter followed on a couple of steps behind.

"Red Rose Trading Estate" a large noticeboard proclaimed. TT looked up at the faded layout plan. He pointed halfway down a list of companies. 'G^3. That's us. Number thirteen.' He walked into the estate.

With a shake of his head Peter followed close behind.

'No-one else wanted it. All that bad-luck superstitious nonsense.'

'It's not the number. It's the public nature of it.'

'Perfect disguise. We're surrounded by "A1 Copy and Design". "B4 U Get There Removals". "A4 Stationers" amongst others. Anyway we've nothing to hide. We are a legitimate research and development collective,' TT replied.

'The legit part is debatable. Every university and government-sponsored bio-engineering faculty in the country are probably still trying to get you outlawed.'

'Pure snobbery. Just because we lack doctorates in empirical science we are ignored as legitimate researchers.'

'Where is this fabled Garage then? Come to think of it why have you never invited me?' Peter asked.

'Need-to-know basis only. You've never needed to know before. Nothing personal.'

'Fine. Just curious.'

TT pointed Peter to a small single-storey unit at the rear of the main block. A Northern line tube train clicked-clacked behind the building as it travelled over uneven points.

'Salubrious place you've got here,' Peter observed.

TT ignored his friend's light-hearted jibe. He punched a sixteen-digit number into a door-mounted keypad. TT's smartphone pinged. He gestured for Peter to enter.

TT looked at his phone and followed Peter inside. 'It looks like your little fracas was recorded. Analysis of the footage should give us a lead on who that device belongs to.'

The industrial building's interior sparkled under a blanket of daylight LEDs. TT hurried over to a small bank of computers on the far side. He flicked a wall switch. The machines started to hum softly as they booted up.

Peter stayed near the entrance. He gazed around the high-ceilinged workshop-cum-laboratory whilst his friend busied himself. Wow TT. This is seriously impressive. Maybe there's some hope for me after all.

'Peter? Put the rucksack down on there,' TT pointed to a high-top table. 'And bring over the micro-vacuum. We'll set the analyser going and see what goodies you've got in there.'

Peter handed over the device. TT placed it in a glass vacuum chamber, sealed it and evacuated the air. With a remote control hand he opened the device and deftly emptied the tiny filter compartment into a tray. TT then pushed this into a sealed housing unit. Once all the preparation was complete he pushed a button and set the analyses cycles in motion.

'Right. That's the tricky part over with.'

'Where did that sample tray go?' Peter sounded mildly interested.

'Into the "microfluidic analyser". That's the one with the latest "lab-on-a-chip" nanotechnology. From there the prepared micro-particles pass through into the DNA microarray for the analyses. Ring any bells? "Future Techs" module?'

'Must have been ill that day.'

TT grinned. 'What would normally take a couple of days or if you were involved a week, now just takes an hour. Impressive. Don't you think?'

'How can you afford all of this?'

'You wouldn't believe me.'

'Try me.'

'Cards,' TT said.

'What? Plastic? You're right. I don't. Not with the mayhem your little troupe have caused. You must be near the top of every credit blacklist in the country.'

'No. Playing cards. I won it.'

Peter looked at his friend. 'That I can believe. Some people have all the luck.'

'Luck? Don't believe in it. Whereas "Enumerative Combinatorics", more commonly known as "random number theory generation", I find much more reliable. It's truly amazing what you can learn to predict.'

Peter raised his eyebrows. He looked up to the ceiling and shook his head.

TT walked over to a makeshift kitchen area. It contained a sink, a breakfast bar, a laptop and a few cupboards. He held up a battered kettle. 'Brew? Can only offer you UHT though?'

'Go on. Got any food?' The thought made Peter feel a bit faint. 'Apart from a couple of Lou's biscottis I haven't eaten anything since last night.'

'Maybe. I'll see if anyone has left anything.' He started to root around the cupboards. 'We should really have a look at what Roger sent us through. The resolution's probably not great but it might give us a start. Ahh. Found something,' TT shouted, his head buried inside a cupboard.

*

Amy walked quietly up the stairs to the first floor kitchen. Her body craved a hit of caffeine.

Streaks of watery sunlight picked out dust motes as they floated up the stairwell.

Early in her professional life Amy discovered her strengths lay in providing colleagues with a safe and secure working environment. These same instincts now told her she should be more vigilant than ever in securing the nature of their covert operations.

Amy tuned into a sound below her in the entrance foyer. She heard the security door open and footfalls move towards Randall's office. Good. He's back. That's one less thing to worry about. He's not going to be overly impressed with the Met though. She turned her attention back to coffee as she contemplated the work ahead.

*

Peter and TT sat at the breakfast bar hunched over laptops. Two mugs of half-drunk tea and a collection of snack wrappers lay strewn in front of them. Peter scrolled through the timeline of Roger's liberated surveillance footage. TT searched for clues amongst the information they gathered reliving that morning's events.

'This is getting us nowhere,' Peter said. 'Are you sure you recognise this guy? I mean why would a professor be collecting field data there and in such a covert manner?' He felt frustrated.

'That *is* Gregory Randall. Once-eminent Professor of Bio-engineering. A few years' back he had me forcibly ejected from a public meeting. It was during a conference on human tissue at the old Central Middlesex Hospital.' TT seemed adamant.

'Funny that. You don't come across as the confrontational type.'

'I was merely enquiring as to why someone with research interests in manipulating the genetic codes of common micro-organisms like *Cladosporium*, *Streptococcus* and *Penicillium camemberti*, seemed to spend a great deal of his time around cadavers?'

'And they threw you out for that?'

'Perhaps I was a bit too persistent.' TT looked sheepish. 'Anyway it is him and something is definitely not quite right. I'm unable to find anything substantial on Randall or his work for the last five years or so. Established scientists don't just disappear off the academic radar.'

'Unless they die or have been pushed?'

'There's no indication of either.'

Peter scrolled through the timeline again. 'Why would anyone want a fight over a sample?' He watched the build-up to events outside the station entrance once more for any clues he may have missed. 'Surely all you'd do is collect another one? If whatever *it* is, is floating freely around the atmosphere it's hardly going to be in short supply or remain undetected for long?'

TT shifted along the bar and focussed his attention in on the footage. 'I wonder what he was hoping to collect in that sample. It must be something important for him to go out during the rush hour?'

‘Hopefully with your box-of-tricks we can get an answer to that even if we don’t know why yet?’ Peter looked across at a large station clock on the wall. It was coming up to six o’clock. In just nine hours my life has gone to pot, he reflected.

‘If there’s something unusual in there with a genetic code we’ll find it,’ TT stated. ‘And if we can’t identify it I know a collective who can,’ he added.

‘You surprise me.’ Peter was grateful for the help TT offered and for the distraction too.

*

Amy returned to the ground-floor base room coffee mug in hand. Her attention was immediately drawn to a blinking red flag in the bottom left corner of one of the monitors. She opened up the dialogue box. ‘Looks like someone’s been trying to track down the professor,’ she said quietly. Well they haven’t counted on me have they? Amy forgot about her coffee as a more rewarding stimulant flooded her system.

‘Let’s see how far you got?’ She started by checking access requests for the various dead-end websites she had set up to act as smoke-screens for both the professor and their covert activities.

These decoys acted as a first line of defence. They were a honey-trap and attracted most of the general traffic. Visitors to these were usually left chasing their own tails.

Making use of cyber-tracking software Amy carefully checked through the last twelve hours of the sites’ browsers. Most appeared to be genuine enquiries with no attempt to hide their IP’s or Internet Protocol address. However there were two particular anonymous visitors who aroused her suspicions.

Each individual computer owned a unique number. This read as a series of digits punctuated by full stops. When this IP was combined with the identity of a computer’s Internet provider known as an ISP, it was normally possible to track down the registered owner. The two suspicious visitors had masked this information.

I wonder if you are who I think you are, Amy pondered. Exactly how much do you know? If her instincts were correct she was intrigued how a positive link to Randall had been made so quickly.

Amy moved onto the next stage and checked the security firewalls. These were in place to physically protect the building’s wireless network from any localised attempts to breach the system. Good. No evidence of any problems here. So it’s purely a cyber-based attack. That I can deal with, Amy concluded.

Thoughts of Taylor and McAvoy played on her mind. With the facts available, as scant as they were Amy had to rely on her immediate suspicions of Taylor and McAvoy as the likely

hackers. She still found it hard to believe that they could have made a tangible connection with the professor.

Amy stood up. She stretched her legs and rolled her neck just to relieve some of the tension and stiffness she felt. After a few minutes of gentle movement Amy turned her concentration back to the tracking data. She carefully examined the search parameters which had been used to try and access information on Randall.

The most common of these terms and combinations seemed to be focussed in on his professional work. “Professor + Gregory + Randall”. “Prof + Greg + Randall”. “Professor + Randall + *”. “Randall *”. And again with combinations of “Synthetic + Biology”. “DNA”. “Bio + Engineering”. “*Streptococcus*”. “Government”. “Security + Services”. “*Cladosporium*”. “Genetic + Research”. “Genome + Hacking”.

Until another attempt was made all Amy could do was sit tight and monitor the situation. She briefly considered informing Simon and the professor but decided against it. Let them do their jobs and I’ll do mine.

Amy’s thoughts of this dissipated as she immersed herself back into a world of circuitry, security and logic.

*

High above the spot where Amy was engaged in cyber-control Dr. Hawkes and Professor Randall convened an informal meeting.

Dr. Hawkes disguised his unease of being alone with the professor. He was keenly aware of Randall’s fierce drive and uncompromising nature. Dr. Hawkes had gained first-hand experience of this unpleasant trait over the past four years of working under him. The biologist busied himself with minor tasks of cleaning and sterilising the glassware which was used in preparing the fresh sample. The gentle murmur of the cooling fans provided the only indication of the microfluidic analyser’s operation as it gently separated, sorted, sifted and tagged genetic codes of organic matter.

‘I think you have probably cleaned those items enough now Simon,’ Randall said.

Dr. Hawkes looked up and shuffled. He put down the Pyrex flask he was in the process of drying off. ‘Sorry. Force of habit. It grows when you work on your own. It becomes an obsession to keep things neat and tidy. For me at least,’ he added.

‘No need to apologise. I wasn’t criticising you.’

‘That’s okay.’

‘Simon. You are aware of the consequences of what we’re undertaking here, aren’t you?’ Randall asked.

‘Yes I think so Professor,’ Dr. Hawkes replied. He seemed slightly thrown by the question.

‘I’m not simply talking about the spore samples you’re decoding in that,’ Randall pointed at the analyser. ‘But rather the implications of what we’re doing. The bigger picture.’

‘I’ve not really given “the bigger picture” much thought. I do occasionally speculate about how many people in the capital we’ve exposed our modified fungal spores to. And also what long-term effects this may have.’

‘And that bothers you?’

‘I wouldn’t say that. Just curious.’

‘I see,’ Randall said. ‘So if I assured you that the spores were harmless and there would be no foreseeable long-term damage, would that allay your conscience?’

‘Yes. I should think so,’ Dr. Hawkes replied.

‘Glad to hear it. Quite rightly all your efforts have been concentrated on doing the science. It’s best not to get side-tracked by politics,’ Randall said. ‘That’s why you are an essential part of this team.’

‘Thank you.’ Dr. Hawkes seemed uncomfortable.

The professor half-smiled. ‘However as a result of this morning’s events we should all be aware of the potential situation we are currently dealing with.’

‘Has something else happened?’

‘No. Nothing like that.’

‘Thank goodness.’

‘On a strict need-to-know basis there are certain aspects of what our overall brief has been and who we ultimately answer to. You only need to know the bare minimum. These days the luxury of deniability could save a career,’ Randall said.

‘Okay,’ Dr. Hawkes uttered. The colour draining from his face.

‘Our work mostly falls under the aegis of Defence. We’re just one of many individual facilities carrying out research into the effects of a potential chemical or biological attack within the London metropolitan area. The department have been using the data which you so efficiently continue to provide, to help construct a predictive model of likely spread patterns, cross-infections and possible casualty numbers in the event of such an attack.’

‘I can see the logic in that.’

Randall nodded.

‘I mean that would make sense wouldn’t it? We need to know what to expect,’ Dr. Hawkes said.

‘As long as you know where we are coming from and what our objectives are that’s the main issue.’

The doctor managed a strained smile and a nod.

‘Right. I think we’re done here. Are you on your way out Simon?’ Randall asked.

‘Yes. Yes I think so. I’ll just change.’ He seemed flustered by the conversation. Dr. Hawkes swapped his lab coat for his jacket and followed the professor out through the air lock.

*

“Beep. Beep. Beep.” A soft alarm sounded in the Garage lab. Peter woke with a start. He slowly focused on TT who was bent over a laptop near the microarray unit.

‘What’s going on?’ Peter asked, barely awake.

‘It’s okay mate you just nodded off for a few minutes. Not surprising really.’

‘What’s that noise?’ Peter sat up. He stretched his arms above his head and yawned. ‘Oh. I feel awful.’ He looked at the clock. ‘It’s nearly midnight.’

‘So it is. That’s just a notification alarm from the microarray. The analyses are complete. I’m browsing the results now. Interesting.’ TT seemed distracted. ‘Come and have a look.’

‘No. Not that. The hissing noise? And what’s that smell?’ Peter wrinkled his nose and coughed. ‘It’s like burnt pine needles?’

TT looked at his friend and then at the microarray. He sniffed the air. ‘Oh that. That’s just the waste processing gases being vented along with any unused test material from the analyser. All sterile by now of course thanks to a process called “extreme heat conditioning”. According to the manual anyway. I wouldn’t worry about it. Have a look at this.’

Peter gathered himself and joined TT who was clearly engrossed in the analytical results.

‘What is it? Have you found something?’

‘Loads of interesting stuff. Look.’ TT moved away from the screen to let Peter have a clearer view. ‘On the left there you’ve got a standard analysis of a control sample from the City of London courtesy of QM. It shows what you would expect with fungi types such as *Trichoderma*, *Chaetomium*, *Nigrospora*, and bacteria groups such as *Streptococcus*, *the Bacillus* family, *Dermabacter* etc. Some are harmless but some of them can be deadly in the right strains, conditions and concentrations.’

‘I do remember some of this stuff you know,’ Peter responded.

‘Sorry.’ TT smiled. ‘I was just trying to set the scene as it were. Okay?’

Peter nodded. He turned his attention back to the screen.

‘The right-hand section should be listing the identified findings found *only* in the micro-vacuum sample after the control matches have been removed,’ TT stated.

The area appeared blank. ‘If your databases are so comprehensive where are the matching results?’

TT didn’t offer any reply. He seemed to be deep in thought.

‘That’s got to be pretty unusual. Wouldn’t you say?’

Again nothing from his friend.

‘According to that analysis, Randall or whoever it was didn’t collect anything out of the ordinary. So why all the fuss? Why the fracas with me? Why were the Met so keen to talk with both of us if all I snatched was a container full of traffic pollution? And you weren’t even there?’ Peter let frustration and questions tumble out of him.

He rubbed his eyes just in case he had missed something. Nothing had changed. This made even less sense than before the tests. He was intrigued by TT’s continued silence. What can’t I see, he wondered.

‘So what do *you* think is in it?’ Peter asked. He knew from TT’s reaction that there was more to this than a blank screen.

‘The Network has access to very specialist biological and genetic databases. If we need to we can request help with an identification,’ TT said. He seemed to evade the direct questioning. ‘It’s usually quite slow. However I think we should use any possible sources of help we can get.’

‘What’s this “Network”?’ You’ve never mentioned them before?’ Peter asked.

‘You’ve never…’ TT started.

‘Needed to know before. Yes I get it.’

‘Their official name is the “Interactive Genetic Coding Database and Synthetic Biological Network”, or IGCDSBN for short.’

‘I can see why it’s referred to as the Network,’ Peter said. He moved back from the screen.

TT logged in to the IGCDSBN database. He opened an email and attached a data file containing the analytical results. TT sent this off anonymously to the Network’s administrators.

‘For now that’s all we can do in terms of possible identification. Let’s see what the actual decoding can tell us.’ He minimised the Network window and opened up the test sample file.

Peter looked on and kept quiet. He knew how TT worked in the lab. It was best to observe and participate only when invited.

‘Right. What have we got?’ TT scanned the list of data for any clues. ‘So what makes some of you so special that my own databases haven’t been able to pick you out?’ TT addressed the decoded micro-organisms.

‘Here we are,’ TT said. ‘This profile is a bit more interesting. Survival across an extremely wide temperature range. Unusual for a fungus. Genome made up of eight chromosomes and

over ten thousand genes. Fairly complex for such a small critter aren't you. Quite similar in make-up to an *Aspergillus*-type fungal spore. I wonder what your party trick is?' TT looked up. He turned to Peter. 'Any ideas on this?'

Peter tried to focus his own thoughts. 'Why would Randall be collecting this particular microbe? If he was willing to fight with a stranger to keep it, it must be worth something to him. Why is he trying to keep it under wraps?'

An email alert sounded. TT's focus was drawn to a multi-coloured flashing envelope icon at the bottom right of the screen.

'That's highly unusual. The Network has sent an immediate reply.'

'That's good isn't it?'

'It's unnervingly quick. I've known it take weeks to get a reply from them before.' TT sounded concerned.

'Open it and let's find out what we've got. If it's a new species we can name it. How about *Aspergillus Peterus*?'

'Somehow I don't think you'd want this type of fungal mould named after you. It could well turn out to be the cause of the next major bronchial epidemic.'

'Oh,' Peter replied. 'Perhaps not then.'

TT hesitated just for a moment. He opened the email.

*

Amy continued to monitor for any signs of intruder activity across the firewalls and smoke-screen websites. One o'clock in the morning. Everyone else had left more than two hours ago.

Her thoughts turned to Randall and Simon. The professor had received her message and was happy to leave all the security concerns to her. A replacement sample had been collected. This time without incident. On his return Randall wanted to put the sample into analysis straightaway hence the lack of contact from either himself or Simon earlier. She saw both of them briefly as they left together just before 10.30pm. The professor apologised for not getting back to her. He seemed relatively unconcerned about McAvoy. The new sample was in the analysis cycle and the results would be delivered to them later today. I wonder if they fully appreciate what it takes for them to work in such a secure and isolated facility. If they did then perhaps they wouldn't be so blasé about the world outside and the hostile threats it contains. But then that's why I'm here. I'm their first and last line of defence.

A multi-coloured flashing icon focused her attention. I wonder who's active on the Network this time of the morning. Probably some junior academic trying to get a reputation for themselves. She clicked on the icon and navigated the IGCDSBN site.

Amy opened the covertly intercepted message. She started to read it through. This has to be G^3. I wonder if Taylor and McAvoy are mixed up in this. They must be. Surely they haven't got that sort of analytical capability? From what Simon said by the time anyone else could reasonably decode the contents the whole thing would have disintegrated into a meaningless bio-soup.

Amy carried on with the email. She held her breath as she read.

*

Inside G^3's Garage laboratory TT and Peter stared at a laptop screen. At the top it read: "Unidentified sub-species". Below this a paragraph of dense text explained in biological terms exactly what they had found.

'If these spores are floating around within the capital's air someone must have identified and catalogued them?' Peter asked TT.

'They may have gone undiscovered but it's highly unlikely.'

'You mean we've actually discovered a new organism?'

'It's more likely to be a GMO. Probably created with a specific purpose in mind.'

'By Randall or whoever he works for?'

TT shrugged.

'You just can't go around producing and releasing a genetically modified organism.' Peter's unease grew the more they discovered.

TT opened up a response email to the Network. 'Okay. So this is what we do now.' He typed his comments as he spoke them. 'What we have discovered seems to be from the *Aspergillus* species of fungi. It bears a resemblance to *fumigates* which can cause severe complications in a compromised immune system. It is an airborne spore so easily taken into the body mostly through ingestion and some absorption. It has significant genetic differences to make it a sub-species but which do not appear to be the result of natural mutation. Nor does it seem to be harmful in its own right. Over the last week there have been no known media reported cases of an unidentified illness amongst London's commuter population. We would have picked up on any reports as official and unofficial sources are monitored twenty-four hours a day. In all likelihood this has been engineered to trial the spread pattern of a potentially harmful organism such as *fumigates* when released in an urban environment,' TT concluded.

'Could it be something that straightforward? A secretive but harmless trial with a benign microbe?' Peter asked.

'It's a possibility.'

'So who's Randall working for? It's clearly not for any academic institution.'

'Your guess is as good as mine.'

TT returned to the Network's initial reply and scrolled through it again.

'What are you looking for?' Peter asked. 'Is there anything I can help with?'

'The Network administrators have asked for any geo-specific information we have on where the sample was collected.'

'That I can do. I was there on the ground,' Peter jumped in.

'And something rather strange. They're asking if the sample exhibited any thermal-specific abnormalities during its destructive testing in the microarray,' TT said.

'What do you suppose they're asking that for?'

'Don't know. They may think it has particular properties which it shows only under extreme conditions.' TT sounded unsure. 'Anyway I'll send them what we've got so far along with our speculative thoughts. It can't do any harm. See what they make of it all.'

TT added a few more notes to what he had already typed and sent off their reply.

'Speculative thoughts?' Peter asked.

'From what we've got so far and this is pure speculation mind you, I would guess that Randall is looking to develop a fungal spore which could target a specific demographic of the population.'

'In this case a benign modified version of the *Aspergillus fumigatus* fungus?' Peter cut in.

'In this case, yes. The next time he modifies it though the resultant spores may not be so benign,' TT replied.

'That's one bizarre theory. For what ends?'

'Who knows? All depends who has commissioned the research. Could be Defence. Could be Health. Your guess is as good as mine.'

*

Amy stared at the multiple communications intercepted from the Network. How on earth had Taylor and McAvoy been capable of analysing the raw data so quickly? Those speculations aren't that far off the mark either.

Her initial explanation on reading the replies to G^3 turned to a leak with the only possible source being Simon. She quickly dismissed this. Amy had vetted him personally. She knew his secrets. She knew he was loyal to her.

A further Network email icon appeared. Surely not G^3 again?

With hesitation Amy opened the newly intercepted reply from the Network. It was another communication from the administrators to G^3. This confirmed her worst fears and more.

Due to the agreed conditions of use, Amy and others in national intelligence could only intercept incoming communications and not outgoing ones but as most users replied directly with the ongoing message stream, it was simple to follow lines of conversation.

She read through the original reply sent from G^3 to the Network and then their reply back.

The Network confirmed their initial agreement with G^3's supposition from the previous communication. This time they concurred that it had almost certainly been modified and as a result would look into the matter with extreme urgency.

Amy knew that this had now become a case of damage-limitation, plausible deniability and the identification of a scapegoat or two. Conveniently she had just the characters in mind.

'Sorry boys. I don't think we'll be allowing you any more access to the Network.' Amy directed her immediate concern towards G^3's current activities. 'Everyone has to pay a price for this. Your burden will be as pariahs amongst the world-wide bio-engineering community.'

Amy typed a succession of security-coded command lines. These were designed to permanently close down an organisation's access to the Network and other essential bio-genetic databases. Just for good measure she added an extra directive: "With immediate effect".

*

TT and Peter read through the latest reply from the Network.

'Definitely looks like we're onto something with this,' Peter said. 'Hey. We can put this up on YouTube or blog it?'

'I don't think that would be a good idea. We need to leak this out slowly. Through untraceable and unconnected channels. Remember what I always say?'

'Stealthily does it,' Peter completed on cue. 'Yeah. I remember.'

TT started to type again.

'More questions?'

'Some. And I need to download and save these mails from the Network's main server. They are the only real concrete evidence we've got apart from the sample records.'

'What about the spores?'

'All used in the array I'm afraid. That type of analysis is a wholly destructive process. Everything contained in the micro-vacuum was either destroyed in the test or else heat-sterilised and vented from the microarray. Remember the smell just after you woke up?'

'Of course,' Peter nodded. 'I wonder if that's what the…'

Without warning the Network disconnected. A second later all the on-screen data disappeared.

TT blinked. It was gone. He attacked the keyboard in a frenzied attempt to rescue whatever he could.

'What just happened? Has it crashed? Did you manage to save any of it?' Peter fired off.

TT tried his best to recover either the connection or the data or preferably both. As he frantically stabbed at the keyboard a new window appeared from the centre of the display. This quickly expanded to fill the whole screen. It did not respond to any of TT's keyboard commands. They both stared at this anomaly, perplexed by a flashing cursor and blank screen.

'Did you just do that?' Peter asked.

'No.'

*

Making use of information obtained from the Network's remote server, Amy established a one-way connection with the G^3 machine. Before she isolated them she decided to send a farewell gift.

As she typed Amy read it back: 'Due to a national security breach your privileges and access to the Interactive Genetic Coding Database and Synthetic Biological Network have been rescinded. This connection is now terminated. It will not be re-instated.'

'Your activities are currently being monitored and under investigation by the UK Security Services. If G^3 are found to have breached national security then it and all of its known associates will be regarded as potential threats to the State. All assets may be seized with immediate effect. There will be no appeal process.'

This should serve as an effective deterrent. It may not be a permanent one but it will give me enough time to tie up any loose ends, Amy thought. She knew she did not have the power to enforce such actions or even if that power legally existed. Blunt tactics usually worked to drive the likes of G^3 so far underground they were rendered obsolete.

'Just one more thing.' Amy removed their access and illegally re-routed G^3's connection from the Network to her control room for monitoring purposes. This electronic isolation of G^3, McAvoy and Thomas would be only the first step.

Amy's feeling of elation was short-lived. Her thoughts turned to what this situation would inevitably lead to. Rounds of pointless meetings and inquiries. Conducted mostly amongst colleagues and like-minded types, the official de-briefing would be carried on behind closed doors away from prying eyes. The Security Services had channels open to them which could bypass the career politicians. It was widely accepted that matters of national security were too important to be left up to the morally bankrupt amateurs of the venerable houses.

She made arrangements to place Professor Randall and Dr. Hawkes on extended leave whilst all matters were cleared up. They would receive official leave orders through their email accounts later that day. Both of them would be happy enough. The final analyses of this stage had almost been completed and they could look over any outstanding results electronically.

Their interpretation and findings could wait for a couple of weeks. She would spare them as always the murky dealings of the State.

Undoubtedly she was sure about one thing. McAvoy and Thomas would spend a great deal of their time in the coming months looking over shoulders and 'round corners, as they wondered just who and what lurked in the shadows.

Amy waited for the security systems to run through their final checks before placing the Lizard Street building into a state of hibernation. She already had her mind working on how to present a mitigating "best-case" scenario. With her thoughts elsewhere she nearly overlooked a new message from the Network to the re-routed G^3 connection.

When did that come in? I'll never get out of here.

She opened the email without hesitation. Amy browsed the message. It was concise. Then she read it in detail. '"G^3. Further destructive testing on this unidentified sub-species of the *Aspergillus fumigatus* fungus is INADVISABLE."' She found herself reading it aloud: '"It is likely that this fungus has been genetically engineered to play host to a complex set of synthetic molecules. Under standard conditions both fungus and complex molecules would be in a benign state. However when exposed to an extreme thermal reaction it is probable that these synthetic molecules have been designed to react with the *Aspergillus* fungus. Any concentrated exposure to this resultant mix could cause acute bronchial complications with an increased risk of fatality."'

Amy paused while she absorbed the details of the stark message. She carried on: '"It is vital you are aware of the material you are in possession of. We will be in touch soon to advise on any further samples you may have. Exercise EXTREME caution."'

Amy looked at the screen. The enormity of the inevitable all-party major inquiry slowly dawned.

Did Simon know what the professor was up to? He must have. How could he not? Did they appreciate the potential dangers involved in what they were testing? Of course they did. Randall had designed and engineered the damn thing. Amy was certain that the professor would have put safeguards in place to protect both himself and Dr. Hawkes. What about her? What about her safety?

Amy had suspected that this trial posed an elevated health risk. Until now she had not realised the full potential of that risk.

Maybe they didn't trust her? Maybe they wanted to protect her? No matter what their initial reasons she would need to know everything they knew. However unpalatable.

What to do about McAvoy and Taylor? Amy thought of the two friends. Do they realise what they may have been exposed to? I doubt it. I'm not sure how useful a warning would be anyway, she reflected. Dispassionate? No. Practical, Amy reasoned. Well they are on their own now. God help them.

Amy closed down the final system. This placed their headquarters in electronic mothballs. She took a last look around and left the security of the building.

*

Peter and TT stared at the screen. Not even the cursor blinked. A mirror image of their shocked faces reflected back at them.

'Was that for real? Tell me that was just someone trying to scare us off?'

'I'm afraid I can't Peter.'

'No. Come on TT? Whoever that was surely hasn't got the powers to do that?'

'These people in the Security Services don't have a sense of humour.' TT looked around him. He was up and moving. Collecting what he needed.

'What are you doing?' Peter looked on.

'Wasn't that plain enough for you?' TT pointed to the laptop. 'We need to get out of here. Collect up whatever you can carry and let's go,' he said in a state of panic. 'Now!'

Peter sat perfectly still. Unable to react. Unable to process the danger they were in. He watched as his friend, rucksack over shoulder and case in hand scooped up the open laptop. Before Peter could say anything TT unlocked the security door and was out into the early morning light.

In the silence which remained it took Peter a couple of seconds to realise what was happening. Once it had he was on the trail of his friend as fast as he could manage it.

END

‘The Patient Experiment’

The Patient Experiment

BRAKES squealed.

'Sorry.'

Tyres resisted.

'Thanks.'

Horns barked.

'Sorry. Yeah you too my friend.' Jake dodged his way across. All four lanes on the Old Oxford Road were solid bumper to bumper. Probably best not to try that again. He made a mental note.

Jake entered a narrow well-screened lane. And as he walked on, an impressive building rose up before him, its golden-grain limestone walls now stained and pitted. Hidden away here in plain sight he wondered if it was originally built as an asylum for the city.

'Centre for Life Experiences,' he read from a tarnished brass plaque. Could still do with a polish.

His interview had been barely a week ago and now he stood on the edge of another beginning. I hope this move isn't a mistake. He looked up at his new place of work, pushed back his dark hair and adjusted his jacket.

Shortly after his first and only visit to the Centre Jake had accepted the post of Junior Researcher. He qualified as a medical doctor over three years ago but had soon become disillusioned with the everyday reality of the healthcare service. His route to the Centre had been both unexpected and unorthodox. Jake was offered the chance to provide temporary in-house medical cover for his hospital trust's psychological facility. He had immediately taken to the patients with uncharacteristic empathy. He had been intrigued by dealing with broken minds. When asked to consider a secondment to the Centre for Life Experiences Jake agreed, not really expecting it to happen.

He hitched up his satchel and proceeded on to the Centre. The sound of damp, crunching gravel amplified around him. Maybe I could give the wards another go, he considered. 'Just see what happens,' he said.

Jake stepped through a neo-gothic doorframe and pushed his doubts away.

The smell never changed. There was always an aroma of malaise which managed to seep out from beneath the mask of sterilising agents.

'Dr. Balfe.'

Jake stood in an anteroom. The level of background chatter coming through was intense. How could anyone work in that commotion? Through the din he strained to hear his name being called.

'Dr. Balfe.'

He lifted his head and walked through into a cavernous reception area. His shoes clicked on the tiled floor. He looked at the ceramic on the walls. No wonder the whole place has the acoustics of a public baths. For the second time that morning he negotiated cross-traffic. Groups of nurses and orderlies moved between day-patient waiting areas and a central staircase which led up to the Centre's treatment rooms. Jake remembered the basic layout of the hospital but not much else. It was a lot quieter a week ago.

'Dr. Balfe?'

Jake saw the petite suited woman who called his name.

'Here,' Jake volunteered as he walked towards her.

'I thought you'd got cold feet.'

'Me? Never. Always dependable.'

'Let's hope so,' she said. 'Belinda O'Rourke. Ward Sister O'Rourke.' She offered her hand.

Jake hesitated then shook it. He discovered the sister had a vice-like grip. 'Jake Balfe,' he said. 'Good to meet you,' he added and flexed his compressed hand away from the sister's gaze.

'So Dr. Balfe, welcome to the Centre for Life Experiences.'

'Thank you Sister. And it's plain Jake Balfe please.'

O'Rourke nodded. 'Professor Johns said he gave you a brief tour of the Centre after your interview?'

'Yes, but I didn't take much in. Sorry.' He felt as though he was back at prep school.

'It's a big place.'

Jake gazed around the reception area and smiled.

'You'll find us rather unconventional in our approach to consultation and care. Most of the patients we have are voluntary non-resident. They are free to leave at any time. There are no locks or bolts here. The only real security is centred on the building's main entrance and exit areas.'

'I see,' Jake said.

'If you think of us primarily as a medical research facility and not a hospital, you will probably begin to appreciate what the Centre is all about.'

'Professor Johns said much the same thing, thank you Sister.' Jake feared he sounded a bit arrogant.

‘If we start with the top floors then work our way down this will give you a general idea of the layout. We can finish up at your research office, Doctor.’

‘Which is where?’ Don’t rise to the bait, just let it go.

‘On the basement level.’

‘Oh,’ is all Jake could manage.

‘It’s not that we want you out of the way. The vacant offices are larger there. And much quieter. The professor thought you would appreciate the extra space.’

‘Thank you. Yes, I’m sure I will,’ Jake replied. ‘A quieter spot does sound good,’ he added.

O’Rourke led the way. She walked fast and in a perfect straight line. Nurses and orderlies alike cleared a path. Jake fell in behind feeling like a medical student once again.

*

Jake collapsed into a well-worn red leather captain’s chair. ‘Ah. Just what the doctor ordered.’ Room B4 as promised was spacious. And quiet. It had also come fully furnished. All looking good so far, he mused.

During the whistle-stop tour of the Centre, he felt he had managed to gain some credibility with the right question here and an intelligent observation there.

Jake looked around the office. Phone, workstation and printer. At least I have everything I need. Makes a change, he thought. O’Rourke had supplied password and log-on details for accessing the Centre’s medical records. Formidable but well-organised. Jake respected that.

He left the relative comfort of his leather chair and booted up the workstation. ‘It will be good to see what my exact duties and rotas are, so I can start to schedule some research time.’ As Professor Johns had explained to him last week and O’Rourke had re-iterated more than a few times during their tour, his post involved a certain amount of clinician time. He was to assist in monitoring the health of the Centre’s in-patients. In return he would be given time and help in developing his research ambitions. This was to be in an area of psychology of his own choosing. It was a very generous trade off.

Jake proceeded to go through the security checks O’Rourke had outlined for him. Once into the system he located a folder with his name on. The files inside seemed to consist mainly of a layout map, general instructions, locations of the various sections within the Centre and a copy of his duty rota for the next month. No official duties for nearly two weeks, he discovered. That’s not bad. He printed off two copies of the introductory pack. ‘I could get used to this level of organisation,’ he said.

*

Thanks to the map, Jake found the basement’s kitchen. He made himself a mug of tea. Hope no-one minds. Must remember to bring some supplies in. He wandered back to his office.

Jake settled into his working environment. He made notes on one of the set of copies he had printed earlier.

'Hello?' A deep voice caught him unawares. 'Hello?' The voice enquired again, accompanied by a light tap on the open door.

All he could see initially was a large hand. 'Hello? Yes. Can I help you?' Jake offered.

The owner of the hand appeared from behind the doorway. He was a large heavyset man with intense green eyes crowned by a slicked-back tuft of brown hair. Dressed in a casual style circa nineteen-fifty, he blended perfectly into the surroundings.

'So sorry. Didn't mean to intrude but I heard someone moving around,' a confident voice replied. 'There hasn't been anyone in this office for a while you see.'

The man stepped forward. He offered his hand to Jake. Unlike earlier he took it without thinking twice.

'Nice to meet you. I'm Dr. …' Jake checked himself. 'Jake Balfe. Jake will do fine.'

'Good to make your acquaintance Jake.'

'Just started today. A junior researcher. Apart from the professor and Sister O'Rourke, you're the only other person here I've met.'

'Ah, Sister. In her case, the bite *is* as bad as the bark. Remember that and she will tolerate you. There aren't many of us full-timers here. You will get to know everyone very quickly.'

'How long have you been here?'

The man looked wistful. 'About seven years. On and off. Seen all types come and go. Some good and some bad.'

I always seem to attract the eccentric types. Suppose I should be flattered. Some of these older doctors are often more institutionalised than the patients they treat, Jake concluded. He smiled weakly at his visitor.

'Well there it is. Nice to meet you Jake.' The man said. 'I will definitely be seeing you around the place for as long as you are here.' He smiled with a warmth which disarmed Jake.

'Oh. Okay.'

'Now must dash. An appointment to keep.' The man turned swiftly on his heels and was gone in a nimble manoeuvre.

'I'm sorry. I didn't catch your name or department?' The man disappeared from view. I'm sure I'll catch up with him again, he thought and turned his attention back to O'Rourke's introductory material.

*

Jake enjoyed the solitude. It gave him time to think about what he had left behind. He didn't miss the continual harassment of being on-call in a busy NHS hospital, although he did miss the structure and familiarity.

It occurred to him that this was the only time during his education and professional life he had been left to his own devices. Although there would always be the odd emergency he would be expected to cover, his current work schedule left him with more than enough free time. He needed to identify a line of research before he wasted a golden opportunity.

His contemplation moved to rumination. Jake had been a year into his position as a house doctor with the Trust. He was covering general duties including shifts on the geriatric wards. That was when the "incident"—as he now preferred to call it—happened. Perhaps he had been a bit naive or just did not possess the empathic skills to relate to older patients. The whole episode had shaken his confidence and severely tested his dedication to medical science. More than a year had passed before he could finally let go of the counselling support. Although it was a help, the therapy mostly served to provide a focus for his disillusionment with the medical profession. The real recovery for him came when he was seconded to the psychology unit at another one of the Trust's hospitals. Within a few days he realised that his future still lay within medicine. Not in the realms of the physical but in the healing of the mind. As a first step it had led him to the Centre and for that he was grateful. The biblical phrase, "Physician heal thyself" was never more appropriate.

The telephone's shrill tone interrupted Jake's introspective mood.

He picked up the receiver. 'Hello?' He listened. After a short while he added, 'Of course Sister.' Following another short pause, 'I'll be there right away.'

*

Jake climbed the staircase four levels up to the top floor of the Centre. He walked over to the east wing. On his journey up from the basement he passed a number of people. Unlike in the NHS everyone he encountered appeared to be in "civvies" or day clothes. The difficulty would be telling the patients and staff apart. He had forgotten to ask O'Rourke about the number of patients the Centre housed during their whistle-stop tour.

He pushed open a solid fire door at the entrance to the east wing. Jake could see O'Rourke standing there waiting for him. I think she already sees me as some sort of slacker, he thought.

'Sister. Sorry to keep you waiting. Still trying to get to grips with the layout.'

'I'm sure you'll soon get the hang of it.' She attempted a thin smile.

This threw him momentarily off-guard. Again Jake stared for a second longer than he should have. O'Rourke looked slightly uncomfortable. He quickly recovered. 'What I said earlier about being called "doctor", Jake or Dr. Balfe is fine with me.'

‘Why would you wish to hide the fact that you are a qualified doctor?’ O’Rourke seemed perplexed.

‘In my capacity here I would like to try and develop relationships with patients as a researcher first and a doctor—if any of them need to know—second. I’d be more comfortable with it that way.’

‘Okay. The decision of course is up to you.’

‘Thank you Sister.’

Jake noticed that they were standing outside what appeared to be a patient’s room. More accurately a patient’s suite of rooms. He moved closer. An official sign on the door read simply, “Room EW3.1”. This was accompanied by a hand-written one underneath: “Please Knock”. In place of a traditional door handle there was a keypad entry system of two rows of numbered polished steel buttons, above a twist handgrip. A circular, toughened window gave visual access to a corridor within and allowed light into the small square space. From this area were two further doors, left and right.

‘This is who I’ve invited you up to see,’ the sister said. ‘This patient is a rather unique individual in many ways. I’m sure you’ll find these out in your own time, Dr. Balfe. He is a voluntary admission and is free to leave at any time. He likes his privacy but also relies on the security which we offer him here.’

Jake looked at the entry system and back to O’Rourke.

‘As you can see,’ she tried the handle and it opened. ‘It is almost never locked. If it is then it’s normally from the inside.’

Jake looked on full of questions. ‘What…’ he started.

‘Please save any questions until we meet the patient. For now all you need to know is that this patient prefers us to call him “TP”. Just those initials.’ O’Rourke looked away briefly. ‘It is his little joke at our expense. However, it seems to offer him a mental barrier to protect his own self. A way to dissociate his own personality from our view of him simply as a “patient”. You will get to know TP well. He will be your main in-patient contact at the Centre.’

‘How many in-patients are there?’

‘Counting TP. Just the one.’

‘One! Is that all? What do the other researchers do?’

‘Oh, we have referrals and day-patients but TP is now our only full-time resident patient. Researchers come to use our facilities much the same as the day-patients do. You are our only full-time resident researcher. Didn’t Professor Johns tell you this?’

No obviously not, Jake thought. He was a little peeved although unsure why. ‘It must have slipped the professor’s mind.’

‘Believe me you’ll have your hands more than full with TP,’ O’Rourke said. The sister let the moment lie for a couple of seconds. She was about to knock and enter TP’s suite when she turned back to him. ‘Normally I advise the new researchers not to believe the tall tales the in-patients tell. In TP’s case they are invariably true. We’ve had researchers who have spent six months convinced that TP was just a compulsive liar.’

What have I let myself in for? Is O’Rourke all that she seems? Maybe this is like some “Hammer Horror” and she’s the in-patient? ‘Okay. I’ll bear that in mind.’

‘I hope you do. More for your sake than TP’s.’

Strange times indeed, Jake mused.

A short sharp round of knocks announced their arrival.

‘Enter Sister!’ a voice said from the other side of the door.

O’Rourke stepped in. Jake followed. He glanced around the accommodation living space. The patient’s face was obscured behind the cover of a scientific journal. *The British Review Journal of Psychology*. Curious reading material.

‘Good afternoon TP. How are you today?’ O’Rourke enquired.

‘Much the same as when you saw me this morning.’

Jake suddenly focussed his attention on the voice behind the journal. I assumed he was a doctor or researcher. A mild panic gripped him. That was TP? I could have said anything to him. God.

‘I just came by to introduce our new researcher Jake Balfe,’ O’Rourke offered. ‘You’ll be seeing a great deal of him over the next few months. Perhaps even longer if you don’t scare him off.’

TP slowly lowered the journal. He looked at Jake and turned to O’Rourke. ‘We’ve already been introduced. Thank you Sister.’

Jake exchanged glances with O’Rourke.

‘Really?’ she said. ‘When was this?’

‘TP paid me a visit shortly after I’d settled in this morning. I assumed he was an employee. A researcher or a doctor,’ Jake volunteered.

‘TP?’

TP looked from Jake to O’Rourke. ‘I heard that we were getting a new research scientist. I thought I would offer a friendly welcome.’

‘You never considered to mention to him that you were an in-patient and not a member of staff?’

‘Sorry Sister. Never crossed my mind.’ TP turned towards Jake. ‘There’s no harm done is there? Everyone knows who everyone is now. I’m sure we can put this behind us?’

Good start, Jake thought. He simply nodded at TP.

‘We may all have a long journey ahead of us. It would be a shame to jeopardise it from the outset.’ TP stood up. He placed the journal carefully to one side and offered a hand in Jake’s direction.

‘As you said – no harm done,’ Jake replied. He shook TP’s hand. ‘Interesting reading you’ve got there,’ he gestured to TP’s journal.

‘No more games please TP.’

‘Wouldn’t dream of it Sister.’

‘Right. I have to go. I do have other work to do.’ O’Rourke stated. ‘Jake. Stay for a while with our patient here. It will give you a chance to get to know each other.’

‘Thank you Sister. That’s if TP doesn’t mind?’

TP shook his head and smiled at Jake.

‘All of the relevant patient notes are available for you on the system. I’ll also have one of the porters bring you a hard copy. If you could read them through over the next few weeks that would be a good start.’

‘Yes Sister. I’ll get on it straightaway.’

‘I’m sure if you find any gaps TP will fill you in. He has a full updated copy of his own.’

‘As I should do,’ TP added.

‘Is that standard practice here?’ Jake felt uncomfortable discussing a patient in their presence.

‘No. Then TP isn’t our standard patient,’ O’Rourke replied. She glanced at TP: ‘Are you?’ and smiled.

Turning back towards Jake: ‘When you’ve finished here let me know. You can ask to page me on any internal phone and I’ll meet you in the dining area.’ O’Rourke left them.

‘I told you her bark is as bad as her bite,’ TP said.

‘The issue is not what you told me. It’s what you didn’t.’ Jake tried to sound annoyed but didn’t have it in him.

‘You never asked. Anyway one way or another we’ll be spending a great deal of time in each other’s company. It’s probably best if we get along.’

‘That sounds like a good idea.’

‘Sometimes monotony does get the better of me. I can be a cantankerous old sod but it doesn’t mean I’ve lost my sense of humour.’

‘As long as it’s not too much at my expense?’

TP replied with a warm genuine smile.

'Well if that was an apology then I accept.'

TP nodded. 'So tell me about yourself? Should I call you Jake or Dr. Balfe?'

The questions caught him off-guard. 'Err…either. Whatever you feel comfortable with.'

'Fine. That's splendid,' TP said. 'I feel like this is the start of a very productive relationship.'

'Yes, let's hope so.' Jake smiled. I bet you've used that charm to good effect over the years, he thought. Be careful of giving everything again: keep something back for yourself this time Jake.

*

'What do you think of your patient then?' O'Rourke asked. 'His medical history is a rather strange and enduring one.' They sat in the main staff dining room. The room was ornate, overwhelming and full of background chatter.

Jake had finished his meeting with TP half an hour earlier and took the opportunity to walk around the Centre before meeting the sister for tea. TP intrigued him.

'He certainly appears to be unique,' Jake replied. 'If possible, I'd like to try to form my own independent psychological assessment of him.'

O'Rourke smiled. 'That would be a good start. Most of the junior researchers we employ have only one thing on their minds: How can I use TP's case to my professional advantage?'

'How do you know I'm any different?'

'No-one ever asked to see TP's complete background before they've started in on their textbook diagnoses.'

'Maybe I haven't got any textbooks yet?'

O'Rourke paused for a split second. 'I doubt that very much.'

The low-level background chatter seemed to rise.

'Did the professor outline your duties?'

'He was a bit vague but I guess I'll find out the intricacies as I go along.'

'Right,' O'Rourke sounded unconvinced.

'His exact words were: "It would involve monitoring and assessing the psychological welfare and medical condition of patients who are undergoing psychological evaluations".'

'Not vague at all then?'

No. I suppose not, Jake thought. I'm clearly not going to be able to win with her. On any level.

Sister O'Rourke finished her tea. 'Let me know when the case notes arrive with you? They should be in your office before you leave this evening.'

‘Thank you. Cheers for the tea,’ Jake said. ‘Would it be okay to take the notes off-site? I like to read late into the night when the world has quietened down. Helps me concentrate.’

‘As long as you’re careful with them and don’t leave them on a bus seat.’

‘Of course not. Thank you.’

‘You’re not scheduled to start formal duties for a few weeks yet. This should give you time to find your feet and adjust to the Centre.’ O’Rourke stood up. ‘We don’t expect you to be on-site when you’re off duty, so feel free to make a start on all your reading at home, if you wish? Any questions you know how to contact me. Goodbye for now.’

Jake nodded. ‘Bye Sister.’

Strange first day at work. Nothing appears to be what it seems. He drained the last of his cup and stood up. Tough nut, soft centre. His thoughts still lingered on O’Rourke as he left the near-empty dining room.

He made his way down to the basement to wait for TP’s case notes.

*

Jake stumbled into his third-storey top-floor flat. Weighed down by a leather satchel and a briefcase filled to bursting with manila folders. Once inside he lowered these to the floor and went back to the hallway to collect an additional box file. He retrieved his keys from the lock and gently pushed the door closed.

After Jake had eaten and watched a bit of television he settled down to start his review of TP’s case notes. He liked working with the TV on and the volume down low. It provided background distraction. Since he found himself alone as a result of the “hospital incident”, Jake used the television for company. The resultant break-up wasn’t Juliette’s fault. She just upped and left. No-one was to blame. It was just one of those inevitable things. A fact of modern-day life. It was easier to start again than to pick up the pieces.

Jake unpacked TP’s case notes and assorted documents. At least they are in some sort of date order. He placed them carefully on the floor in front of what they had come in. He didn’t want to get them mixed up and spend an age sorting them back into the appropriate bindings.

‘Let’s start at the beginning then.’ Jake picked up a case note folder marked “Centre for Life Experiences: Medical Case Notes” followed by *TPE-00-01-MED* dated 23/08/03. Amongst the fluorescent-coloured paper dots a record of appointments, doctors’ initials, consultation dates, referrals, medicines and treatments prescribed all loosely written on a printed grid, littered the front of this folder. He glanced over the subsequent folders from both the box and briefcase. He saw a similar pattern repeated. Seven years is a long time for observation. TP has

obviously been the subject of an intense period of prolonged and concentrated study. Why for so long?

Jake turned his attention to the pile of folders unpacked from his satchel. There was a subtle difference both in the (dis)colouration and in file format. He reached over and took the top one. “Centre for Life Experiences: Psychological Case Notes” followed by *TPE1-00-01-PSY* dated 02/06/07. Again it had a similar mixture of dates, names and recommendations on its cover. Wonder why psychological evaluations were only recorded in their own right after four years of medical assessment. Jake flicked through the notes and put them back on the satchel pile.

One thing was evident from both types of folders. A large number of medical personnel had both considered and commented in detail on TP’s “condition”.

Jake returned to the original “-01-” medical notes folder. After reading through the cover annotations he was alarmed by some of the comments. He turned to its contents. To Jake’s surprise the opening page was a disclaimer agreement between the Centre and the “TPE1”.

‘TPE1?’ he said quietly. ‘The Patient…something or other? So, that’s what “TP” stands for: “The Patient”. O’Rourke was right about TP’s deadpan humour.’ What’s the “E” stand for? he wondered. Exploration? Explanation? Exposition? *Experiment*? Surely not. Jake felt a cold shiver run over him.

Amongst other things, the disclaimer authorised the Centre to use the subject TPE1 for an ongoing series of experimental observations and tests associated with resuscitation after clinical death. As part of the Centre’s obligations it had agreed to look after the medical and psychological wellbeing of TPE1. It also consented to terminate the experimentation if TPE1’s quality of life dropped below accepted medical and ethical standards. Jake noted that the patient had requested that his identity remain secret. There was also a declaration of no existing family. Effectively the Centre has total control over TP’s life, he concluded. Even if this was legal is it ethical?

After reading the finer detail of TP’s “living will” Jake imagined a fleeting image of Lindsay Anderson’s *O Lucky Man*. He dismissed the grotesque scenario of the fictional hospital ward. In an attempt to break this distracting line of thought, Jake retrieved a pencil and small journal from his briefcase.

He turned his attention back to the folder. Moving on from the unusual agreement Jake started to examine the medical history of TP. He began to make notes as he progressed. Quickly engrossed in his new-found activity Jake settled down, his concentration fully focussed.

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Jake lost track of time. Over the last few days he had become drawn into TP's case notes. Eventually he reached a point where he could absorb no more. Jake felt he had established a clear overview of TP's condition. He also managed to form one of the Centre too. At best, it seemed at odds with his ideas of patient welfare.

Although his official duties did not start for another week Jake decided to take his work back into the Centre. Although he had craved isolation in the past, he knew it was not always the healthiest option. He had diligently read through TP's early medical and psychological case notes and scanned over the latter ones. Before reading any more he decided to find out if there was any background material outside of the case notes. Jake had many queries on the notes themselves. Perhaps TP was in a better position to answer any of his questions. Jake knew the correct procedure would be to approach Sister O'Rourke first.

*

Jake collected his personalised security pass complete with digitised photo-image from the Centre's reception. He was asked to wear it around his neck using the black lanyard provided. Wonder why that is? Jake thought back to his first encounter with TP. He made his way down to the basement.

Jake had left TP's case notes at his flat, as it seemed the safest and easiest thing to do. True to her word O'Rourke had arranged access to an electronic copy for him via the Centre's internal system. He took out his journal and began work.

He remembered teabags and milk so didn't feel so guilty about using the staff kitchen again. As he finished fixing himself a mug of tea a young woman walked in. He quickly glanced at her ID which hung on a red lanyard just to check she was actually a staff member. She was. He felt embarrassed as he found himself staring at her chest. According to her ID this was "Staff Nurse J. Arthurs". Jake estimated that she was in her late twenties. Her pale complexion and green eyes were a striking combination.

'Don't worry. I was always checking who was who when I first started,' Nurse Arthurs said in a soft Glamorgan accent.

'Sorry. I didn't mean to stare. That's really rude of me.'

'That's okay. You're the new researcher, Jake Balfe. Or is it Dr. Balfe? I'm staff nurse Jayne Arthurs.'

'Yes, that's me. Either is fine,' he replied. 'Nice to meet you Jayne.'

She smiled at him. 'Likewise Jake. You found the kitchen then. That's a good start.'

He nodded.

Jayne looked at his meagre supply of milk and teabags. ‘Don’t worry about bringing anything in. It’s all replaced and topped up on a daily basis by the catering staff. They’re a good bunch.’

‘Useful to know, thanks.’ Jake felt a bit foolish.

‘And if no-one’s told you the staff dining room is free too. So there’s no need to cook when your shift ends. It’s open twenty-four hours including weekends. There’s quite a few perks here. A bit more than the local NHS Trust. Is that where your last post was?’

‘Yes,’ Jake said. ‘I needed a change of direction. I was very lucky to get the break here.’

‘Sorry. I didn’t mean to pry.’ Jayne seemed to sense his reticence. ‘How are you settling in?’

‘Still finding my feet. It’s only my second full day on-site. I’ve been working at home most of the week, trying to catch up on medical histories and case notes before my rota kicks in.’

‘I don’t think you’ll find it too taxing. Your only responsibilities are for the resident in-patients. You know there’s only one these days don’t you?’

‘TP. Yes. But I thought I might have seen some of the other patients. The referrals and outpatients? Just to help out?’

‘There’s no need. Everyone has their own area so there’s no real crossover. TP’s quite demanding. Your hands will be full enough just with him.’

‘I see.’

‘You’re in a privileged position. Since the last of the other in-patients passed on more than two years ago, TP’s the Centre’s most prized possession.’

Jake considered this.

She reached around him to the fridge, took out a bottle of *Lilt* and turned to leave. ‘Maybe I’ll bump into you in the dining room sometime,’ Jayne said. ‘Anyway nice to talk to you Dr. Jake and see you around.’

Before he could ask her to elaborate on the importance of TP she was gone.

“Centre’s prized possession.” “Privileged position.” Jake pondered on the nurse’s departing words. They’re odd phrases to use about a patient.

Jake felt his mug. It was tepid. He switched on the kettle and deliberated on the exchange with one very well informed nurse.

Jake opened his journal and flicked through to the observations he made on TP’s case notes. He logged into the workstation and located the electronic copies of TP’s medical and psychological folders.

His written observations consisted of just a few words or a phrase preceded by the case folder, date and page location. “*TPE1-00-01-MED* / 23-08-03 / #1: Living Will – legal / ethical?”

It was a robust system which meant he could keep track of his observations and what they initially applied to.

Jake browsed his remarks. These sparked further musings.

“Reversing clinical death.” Nothing new about this sort of stuff. It happens every day in A&E.

“No medical history of anything unusual in TP’s past.” Always appeared fit and healthy. Much the same as now.

“Complete failure of central nervous system. No evidence of brain or cardiac activity. Two instances of this.” Even with artificial electro-chemical resuscitation both these occurrences should have been the end of him. Is this right, he thought. Jake wondered about the accuracy of the case notes.

“Focus on *Noradrenalin* in investigating how TP’s body copes with total shutdown.” I wonder why this particular neurochemical was focussed on. Stress? Fear? REM sleep? Can’t think of any direct medical resuscitation procedure using *Noradrenalin* as substitute for pure *Adrenalin*, Jake reflected.

“More episodes of complete nervous system failure regularly occurring over the next few years. Again a successful return to full health.” This TP is some kind of bizarre medical anomaly all right but there must be a reason why he’s still here. It’s as though the observations have become experimental in nature. I wonder if this is what TP expected when he signed his *living* body away to medical science.

‘“Shift in focus of Medical Obs to Psychological Obs (*TPE1-00-01-PSY*) starting 02-06-07. A new system of case folders introduced to consider the psychological effects on TP. The main concern here seems to be the effects on him of being brought back from clinical death after suffering so many cardiac arrests”,’ Jake read aloud. This is where it starts to get very interesting. At this point it looks as though there had been observations made which pointed to a more fruitful approach for research being pursued along psychological lines. Hence the introduction of a variety of psychological researchers, he concluded. Jake had noted a host of different names on the folders’ jackets whilst browsing through them the previous night.

“Notes made on TP’s changing psychological profile reveal a distinct attitudinal change in his outlook on life. He has reported less stress and anxiety. There are also improvements noted in his mental health. TP had stated that he had always been quite highly strung, materialistic and anxious about everyday life.” Sounds as though he would have been diagnosed borderline obsessive/compulsive these days. Jake carried on browsing through his own observations.

‘“A year into the psychological assessments (*TPE1-00-13-PSY* / 26-07-08 / #23). TP seems to be exhibiting some remarkable psychological benefits from his death/resuscitation (*D/R – my*

annotation) episodes",' Jake read out. "A significant number of "near-death" and cardiac arrest survivors display emotional stress-related symptoms similar to those of *PTSD* suffered as a consequence of battle or trauma. However there are cases were the D/R subject does exhibit a long-term beneficial psychological effect. This seemed to lead to the subjects experiencing a more *peaceful* and contented existence if compared to a time before the D/R episode occurred."

Jake pondered over this last point for a while. If I were looking to make a name for myself and a potentially lucrative practice in the future this would be the field I'd be interested in. Perhaps this should be the subject of my own research? After all I'd have access to the best primary source material there ever was.

An idea sprung into his mind. How about a clinic where death was purposely induced to help correct mental health imbalances including materialistic addictions? For the common good of course. On the flip-side there would always be the private clinics with only profits in mind. Which washed-out drugged-up aged rocker or clinically depressed former D-list starlet wouldn't pay handsomely for recreating the positive transformational effects of a near-death experience? Jake's thought process carried on. The applications were endless as were the potential financial rewards. What a horrendous abuse of medical science that could turn out to be.

Before Jake could get further mired in the ethics of such research and its possible applications he was brought back to reality by a short sharp knock on his door. O'Rourke, he guessed.

'Come in Sister.' The door was pushed inwards. 'Sorry, I should have kept it open but there's a bit of a draught down here,' he added.

'It's the best we can do for a researcher I'm afraid. All the upper floor offices are reserved for out-patient doctors,' O'Rourke said. She walked into the office and casually looked around.

'As it should be Sister. What can I do for you?'

O'Rourke turned to face him. 'I was informed by reception that you had collected your pass so I knew you were back in today. I also overheard Nurse Arthurs gossiping in the canteen. There's no privacy here. Just thought you should know.'

'Chatter and hearsay. Nothing new there. Thanks for your concern all the same.'

'No need.'

'Anyway. I'm sure that you didn't come down here to pass on workplace advice,' Jake said.

'Probably not.' She straightened herself. 'I was wondering if you have read through TP's case notes yet? And whether you had any questions about his condition?'

‘Yes and yes. I was hoping I’d see you today. I managed to get through the initial sections of the notes and have skimmed the rest for now. They’ve given me a good indication of his “condition” as you call it,’ Jake replied. Choose carefully, he thought. ‘I do have a great many questions but I didn’t know whether you were the right person to approach?’

‘Oh. I see. Why would that be?’

‘It’s nothing personal Sister.’

‘Funny, a comment like that’s always personal,’ she fired back. ‘What then?’ she added.

‘I was going to ask you whether it would be appropriate to put my questions directly to TP. You said yourself that he knows his own case notes like no-one else. And after all I am being employed to assess both his mental stability and suitability for continued experimentation…’

‘We prefer to use the term “observation”,’ O’Rourke cut in.

‘Continued “observation” then,’ Jake completed. ‘What better way to assess both by talking to the subject himself?’

‘I see.’

‘Part of the reason why I am here to get inside TP’s head. The most effective route for that is to talk to and observe him in his own familiar space.’

‘That seems a fair request. I suppose you will end up talking to him candidly at some point. You might as well start as you mean to go on.’

‘Thank you, Sister.’

‘Can I also remind you that you are employed as TP’s medical doctor too?’

‘Yes. I’ve not forgotten.’

‘Sooner or later you will observe TP’s next arrest. Your research work could both be the reason why he is saved *or* conversely why he is finally left to rest. As his physician this final choice may at some point be left in your hands.’

Jake pondered on this. He looked at Sister O’Rourke. She appeared steely but compassionate. I just can’t figure you out. ‘I am starting to comprehend both the opportunity and responsibility which come with this post.’

‘Good. I’m glad you are.’ She turned to leave. ‘By all means discuss the notes with TP. If you still have questions, you know where to find me.’

Jake nodded.

‘Empathy is a fine thing but it can be misplaced. Just don’t let it cloud your professional judgement. It’s all about what is best for the patient.’ O’Rourke left his door ajar.

*

Later that evening on the way back to his flat, Jake mulled over the conversation with O'Rourke. She was right to put me in my place. I should be the last person who needs a reminder of misplaced loyalties.

As Jake stepped into the hallway the sister's phrases still picked away at the recesses of his mind: "…or conversely why he is finally left to rest. As his physician this final choice may at some point be left in your hands". He chewed this over but knew exactly what she meant.

'Part of my duties could be to offer a terminal solution to a dying patient,' he said out loud to confirm its reality.

*

Before his duty rota started, Jake spent a few more days working through the case notes. In-between this he visited TP a couple of times but did not seem to make much headway. He enjoyed two more visits from Sister O'Rourke and lunch with Jayne. But Jake had reached an impasse. He needed to engage with his patient on a more detailed level. Whether TP likes it or not we need to talk about his experiences.

Jake started to form the basis of a practitioner to patient bond with TP through a few short additional one-to-one meetings. He needed more time with TP. His patient seemed reluctant to engage with Jake's deeper enquiries. So far their meetings were always on the brief side. TP said he became tired easily these days. Jake wanted to try and clear up some of the questions O'Rourke had successfully evaded. Mainly those relating to the more ethical and moralistic aspects of TP's treatment.

*

Jake sat in his office lost in thoughts of TP's situation. What I need to do is pull all the current material together I can to help build up an observational picture of TP's mental wellbeing. It's such an obvious omission from the psych notes. How could anyone have missed that?

Jake read over the last entry from his journal. "It is clear from the brief meetings I have had with him that in my opinion TP's mental health is in a state of slowly spiralling degradation. It has probably been so for some time. I can only assume that a similar observation had been reported by my predecessors but I am yet to find any evidence of this in the case notes."

Jake mentally sorted through his own findings. He could only assume that this probable conclusion was in a report yet to be filed. If it didn't exist then he should be concerned.

He turned his mind back to visiting TP. From previous experience he thought it wise to check whether his patient was available. He picked up the phone and dialled zero.

'Hello. Centre for Life Experiences. Reception. How can I help you Dr. Balfe?' a confident female voice asked.

Jake could not get used to the efficiency of the CLE. He had given up the futile pretence that he wasn't a qualified medical doctor within the first few days. Everyone knew who he was. He became bored of trying to correct them all.

'Good morning. Is it possible to find out if TP is available for a meeting during the next hour or so? Could you please call me back when you know?'

'If you stay on the line I should be able to find out straightaway Dr. Balfe,' the voice said. The connection switched to a pulsing tone. After no more than ten seconds this disappeared. 'That would be fine Dr. Balfe. TP said any time would suit and he's looking forward to seeing you.'

'Great. Thank you.'

'Is there anything else?'

'No, thank you. That's all thanks.'

'Very well. Thank you for calling.' The line went dead.

No time like the present. Jake gathered his journal along with a number of selected folders and placed everything in his satchel. He put the computer workstation into a secure hibernation mode and left for TP's rooms.

*

Jake knocked on the open door of Suite EW3.1. He momentarily transported back to his first year of medical school waiting to be called into a tutor's office.

'Come in Jake. The door's open.' TP's deep welcoming voice beckoned him in.

He walked through the short entrance hall and turned left. Jake had the hang of the layout.

'Morning TP. How are you today?'

'Come on in. Have a seat. It's good to see you.' Although TP was standing, he motioned to a leather settee beneath one of the overly large picture windows. 'Much the same as the previous day and the day before that. Thank you for asking all the same.'

Jake sat as requested and opened his journal. He found it odd that whilst TP's suite had everything you would find in a good hotel there was no kitchen or even a kettle. TP said the dieticians were very strict and rigorously controlled his diet. It seemed a clash with the Centre's idea of independent living. In their brief talks TP had clearly found this irritating but it wasn't worth causing a fuss over. At least he never need worry about washing up, he had pointed out with a wry smile.

'I know you don't like long chats TP. So if it is okay with you I would like to get straight into it?'

TP nodded. He stood perfectly still. 'That's the way I like things. Uncomplicated and straightforward.'

‘Good. After our last meeting I made a few notes.’ He tracked though these with a pencil.

‘Oh yes? What were your conclusions?’ TP asked.

‘I’ll come to those in a minute. I just need to clear up a small number of things first.’

‘Fine. Fire away.’

‘Although my main work here is to do with psychological research I find your whole clinical history fascinating. It goes against everything medical science teaches us about the effects of cell death and the process of dying.’ I need to be as sensitive as possible here, Jake thought. ‘But in my research capacity I’d like to focus in on the effects of continual resuscitation on your emotional and mental well-being. Any assessment I make will affect how the Centre addresses its ethical and moral duties towards you.’

‘Yes. I am fully aware of your role. Ultimately you could be the person to put my permanent death in motion. You could finally lay me to rest,’ TP said.

Jake considered this for a moment. ‘I suppose that could be true. But I can only make recommendations.’

‘In your role as a psychological observer, yes. But not when you assume full duties for my medical care. You will be in a position to act on those life or death decisions directly.’

‘Which is why I’m here today. Your choice about your own life and death.’

TP nodded. ‘Go on.’

‘I’ve completed a thorough reading of your extensive folders and case notes. The most disturbing item has to be the disclaimer you signed in your “Living Will”. I’ve no doubt of the validity of it and that you were of sound mind but medical ethics have moved on in the last seven years. I don’t think such an agreement signed today could be as binding. Not only does the Centre have control over what they do to you but also over the mechanisms to prevent them from doing it.’

‘And your point being?’

Careful, Jake thought. ‘My interim conclusion is that you are caught in a slow but noticeably downward spiral. As a result there continues to be a degradation of your mental well-being and acceptable quality of life.’

TP looked pensive at Jake’s statement. ‘The point with a spiral is that once you’re caught in it there are two things which are inescapable: there is a finite point, and the more you fall, the quicker that finite point is reached. I was in engineering. These certainties I can appreciate.’

‘I would suggest that your experience of well-being “highs” followed closely by depressive episodes then stabilisation, has been spiralling in on itself for at least eighteen months.’

TP nodded. The lines on his face appeared to deepen.

Jake wondered if he had gotten to the point a bit too bluntly.

The retired engineer took a seat in the single recliner opposite. Jake could see that TP was upset by his analysis.

'This isn't wholly unexpected,' TP said. 'I had known in myself for the last two years I was becoming unhappy for longer periods after each event and treatment,' he added. 'I just simply didn't wish to see it. Neither did anyone else. The rewards are very generous for everyone involved. Including myself,' TP admitted.

Jake stayed silent. Notions of mercy-killings and euthanasia flashed through his mind fuelled by those of his own medical mis-judgement. He dismissed these feelings. He was still a doctor in consultation with his patient.

'I'm not saying that I wish to die. I would just like to take my chances with mortality. Same as everyone else.'

'Whether you want me to or not I'll have to report back to Professor Johns,' Jake said. 'However it can wait for a few months, if you wish?' he suggested.

TP looked him full in the eyes. 'The sooner the better for me. I'm ready now to have a choice over my own fate. I can't deny the past seven years have been good for me. They've served a useful purpose but I believe that has run its course. And so have I.'

Jake made no sign to either to agree or disagree with TP. He looked over his own notes. 'Whoever the previous psych researcher was they also drew similar conclusions concerning your mental well-being. Albeit anonymously. Perhaps they presented a report no-one in the Centre wanted to see?'

'Her name was Dr. Lenka. Krystal Lenka. Nice manner but ambitious and head-strong.'

Jake nodded. 'If there was anything formally submitted it appears to have been buried somewhere along with the future career of your Dr. Lenka, I suspect.'

'Krystal left abruptly two months ago.'

'There's no record of her name on or in your case notes. Doesn't seem right does it? Perhaps I'll make some discrete enquiries.'

'You should be careful. It seems as though there is a great deal here at stake for both of us.'

'I'm more concerned with your quality of life.'

'And death,' TP said.

Yes. And death, Jake thought.

'I think we should leave it there for today don't you?' TP announced. He turned his head to one side.

'I'll try to not let you down in the same way,' Jake whispered. He was glad that TP's gaze was elsewhere. He collected the satchel and left his patient to reflect on their candid conversation.

*

That night Jake drifted in and out of a restless slumber. However much he pleaded for it a deep nourishing sleep evaded him. In fitful bouts he was confronted by an alternating version of his former troubled patient, Laura Miles. First there appeared the serene apparition, who was a kind and gentle soul only to be replaced by the possessed and crazed form caused by months of suffering as illness took hold. These two competing versions pleaded with and cajoled him to bring an end to their terminal suffering. As in life, the ghostly visions achieved their goal, leaving a young naïve doctor's reputation, personal life and career in tatters. These episodes were abruptly followed by a fraught contorted impression of TP as he struggled with his existence and his wishes for a permanent death to finally bring him the peace he craved. The images dissolved each time on waking. A vivid but fading afterimage was all he recalled. This pattern repeated itself over and over until Jake finally succumbed to exhaustion.

A faint polyphonic crescendo stirred the darkness. With a start Jake connected the sound to his phone.

God! What time is it? He grabbed his wristwatch from the floor beside his bed. 'Ten to five. This better be good,' he grumbled.

Jake picked up the handset, 'Hello?'

'Sorry for the early morning call doctor.' The female voice sounded apologetic. 'It's Nurse Arthurs from the CLE.'

'That's okay Jayne. I was having a lousy night's sleep anyway.'

'Sister wanted me to contact you urgently.'

'Why? What's happened?' Jake's fatigue was pushed from his mind.

'It's TP. He's had one of his "episodes".'

'Oh God. I was only with him a few hours ago.' Jake collected himself. 'Is he okay?' No, of course he's not. That's a stupid question, he thought. 'Is his situation stable?'

'That's why Sister asked me to contact you. He's had a particularly bad one. At the moment it is still touch and go. The Resus team are working on him. From my own experience they could be in there for hours. Sister wants you here. Now.'

'I'm on my way. Although I don't know what I can offer?'

'She wants you to observe and witness the procedures involved in TP's resuscitation. It can be quite disturbing,' Jayne said. 'I think she also mentioned something about assessing his mental state during the immediate post-resus period.'

‘Okay. Whatever the reason, I’m on my way now. Tell Sister I’ll be there as quick as I can. Bye Jayne.’ Jake stood for a few seconds whilst the conversation sank in. He started to dress and gather his things together.

Five minutes later amidst the darkness of a mid-November morning, he was in a minicab en-route to the Centre.

*

On his arrival Jake was directed to an unfamiliar section of the building. He passed by TP’s suite to an area more befitting a modern-day hospital. So this was where the medical treatment wing was.

As he continued on deeper into the corridors Jake saw a familiar figure up ahead. Jayne silently acknowledged him. She beckoned him towards a pair of theatre doors. He opened his mouth to speak but the nurse shook her head. Jayne handed him a pair of green scrubs, a cap, a face mask and a large sealed antiseptic wash wipe. She waited for him to disinfect his exposed skin and gown up, then led them both into the operating theatre.

The sight which greeted him would have been at home amongst the pages of a thriller from Cook or Crichton.

The first thing which struck Jake was the spectacle of a prone TP. He was suspended in a clear liquid housed in what resembled a translucent oversized fridge freezer. The second was the quiet. This was punctuated only by the pings and mechanical sounds from the vast array of medical equipment present. Amongst the eerily silent but animated theatre staff TP appeared lifeless. The host of screens which surrounded the enclosure showed that he was teetering on the edge of life. His heartbeat murmured and was irregular. His blood pressure seemed abnormal. His breathing barely noticeable. TP was being sustained artificially. Not uncommon, Jake thought. His body must have taken an awful shock for his vitals to be in such poor shape. You may get your wish sooner than you hoped for TP.

Jake moved closer to the chamber. He noticed it wasn’t fully translucent but covered in a thin sheet of frost. Alarmed by this he searched the screens. ‘Core brain temperature. Thirty-four degrees Celsius,’ he read to himself. Is that right? Why is it so low?

The sister seemed to have been following Jake’s reaction since he entered the theatre. She carefully followed his actions and what he took an interest in. She moved up beside him.

‘That’s right. Core brain temperature of thirty-four degrees Celsius,’ O’Rourke confirmed in a whisper.

Jake jumped, startled by her close presence. He stared at her and then back at the chamber. How did she know what I was thinking?

‘We had this resuscitation chamber built specifically for treating TP. To help aid his immediate recovery by minimising the risks of brain injury.’

‘Is he still alive?’ Jake’s eyes stayed with TP.

‘Just about,’ she replied. ‘He gave us a real scare this time. We were there within seconds of him going into cardiac arrest. This is the point where complications with “normal” patients start as you’re undoubtedly aware.’

‘Yes. I’ve witnessed a few in A&E.’

‘So you’ve seen enough to know a *normal* one then,’ O’Rourke said. ‘Once the heart stops unless it’s started again the stored reserve of oxygen in cells and brain cells runs out in around two minutes. Possibly resulting in irreparable brain and tissue damage.’

‘And?’ Jake felt irritated by the apparent experimental nature of what he saw. Not to mention being lectured to on emergency medical practice by a nursing sister.

She did not respond to Jake’s abruptness. ‘This is the unique reason TP is of uncommon interest to us, as well as the rest of the medical world. His cells simply do not seem to run out of oxygen the way “normal” people’s do.’

Jake turned to look at O’Rourke. ‘What? That’s impossible. A human cell can only store a minimal amount of oxygen. Usually just enough to naturally overcome a very short deprivation event. A mild heart attack or a minor stroke or some other temporary physiological damage.’

‘That’s what we’re taught. That’s the reality in almost one hundred percent of the cases. But.’

‘But what? All the research and textbooks are wrong?’ Jake looked back to TP who existed on the edge of life. Every function monitored and recorded for medical science. And for what else, he wondered.

‘In TP’s case oxygen levels in individual cells remain constant. This allows those cells to operate at a reduced capacity until the heart is pumping again. TP’s case is not unique. There have been a handful of similar instances over the last few years,’ O’Rourke finished.

Jake thought about TP. He considered the picture the sister was painting of TP’s condition. His head swam with questions. I need to focus on what this is doing to TP’s well-being. Not what is best for medical science or the Centre, he confirmed to himself.

‘How does this “condition” keep TP’s mental and bodily functions in a safe state as physical death occurs?’ Jake asked.

‘Because of the continuous presence of oxygen there’s no opportunity for anaerobic respiration.’ The sister seemed keen to keep Jake’s medical curiosity engaged.

‘Therefore no build-up of toxins in the cells as there’s no need to burn up stored ATP energy,’ Jake observed.

‘Exactly. So in TP’s case he clinically dies but his cells live on in a semi-dormant state for a prolonged period.’

‘Almost as if his cellular structure goes into hibernation.’

‘Spot on doctor.’

‘Have you discovered how the cells manage the ability to retain constant oxygen levels?’

‘Not the whole picture but we’re working on it. With TP’s help of course.’

Jake winced behind his mask. He doesn’t have much choice.

‘All I can say is there seems to be an abnormality within a particular section of TP’s genetic code. This results in his cells being able to maintain and regulate oxygen levels independent of how the rest of his body chemistry is reacting,’ O’Rourke said.

‘This must put an incredible strain on him? Even as fit and healthy as TP seems, he is an elderly man.’

The sister paused. Jake thought she might open up more.

‘We can’t stop him suffering cardiac arrest nor falling into clinical death. The best we can offer is to guide his body through a unique recovery process. As long as we can get him into treatment within a reasonable time frame there is every chance of him making a full biological recovery,’ O’Rourke replied. ‘In usual circumstances,’ she added.

‘What do you mean: “In usual circumstances”?’

‘Nurse Arthurs told you that this episode was proving to be a complicated one?’

‘Yes. But I’ve no reference points to base this on. None of these treatments are detailed in the case notes.’

‘They are there. Just not explicitly so. We have our reasons for that. As does TP. The Centre has invested a great deal into TP’s welfare.’

‘That’s one way of looking at it I suppose. There could be another interpretation of the Centre’s secretive approach though: human experimentation?’ Jake stated.

‘There’s a time and place for discussions on medical ethics. But it is not here and not now Doctor,’ the sister said.

Jake stared at the chamber containing TP and kept quiet.

‘I sent for you just in case this episode proved to be TP’s terminal one. Thankfully it looks as though he will pull through.’

Jake mulled this over for a few seconds. ‘You mentioned before “in usual circumstances” TP is put into an uncomplicated recovery process. What has gone wrong this time?’

‘Are you familiar with the term “Reperfusion Injury”?’

‘Not overly. I know it’s quite a new concept. It’s something to do with the increased presence of oxygen free radicals in the blood system after resuscitation.’

‘Very succinctly put.’

‘I read a lot.’

‘Reperfusion Injury occurs as blood starts to pump around the body after successfully restoring a heartbeat. As the vascular system regains its integrity the build-up of this toxic free radical form of oxygen can be harmful. At an extreme level it can cause irreversible damage in areas such as the brain cortex.’

‘What has this got to do with TP? From what you have just said the oxygen supply would inhibit any free radical activity?’

‘An in-depth interest in advanced physiology as well? I’m impressed. It all depends on the density of free radicals in any one cell.’

Jake nodded.

‘Until quite recently TP has never shown any signs of being affected by RI.’

‘So what’s happening to his body chemistry now?’

‘During a previous episode we noticed a high percentage increase of oxygen free radicals in his system. This was only after they had already done some minor damage. We weren’t looking for them so it caught us unawares.’

‘TP recovered from this?’

‘Yes,’ O’Rourke replied. ‘Although he did sustain some short-term memory impairment.’

‘Is there any sign of further damage this time?’

‘It’s too early to tell.’

‘But?’

‘We think the numbers of oxygen free radicals had substantially increased in TP’s system prior to resuscitation,’ she said.

‘That doesn’t sound good.’

‘On the face of it, no. However one positive action we were able to take was to place him in the chamber *whilst* he was undergoing cardiac arrest. TP’s brain temperature was significantly cooled at the time when most damage could be done. We know cooling limits the amount of injury caused during post-resuscitation care.’

‘Hence the frost on the chamber,’ Jake observed.

‘Exactly. We can only hope this may lead to a breakthrough for TP. If it works it could also mean significant improvements in the standard treatment of all cardiac arrest patients.’

‘Have you identified any likely sources of the free radicals?’

‘The Centre has funded a number of research programmes both here and amongst the Russell Group.’

‘Those Institutions know about TP?’

‘No. That wouldn’t be wise. TP’s existence is kept a well-guarded secret. Something you’ll be aware of from the confidentiality clauses you signed in your own contract.’

Jake nodded.

‘Our own research scientists at the Centre have been looking at probable causes of the free radicals. Some of their initial findings suggest the increase could be down to the suppression of some of TP’s naturally occurring antioxidants.’

‘So it’s not necessarily a problem of increased production but rather the decreased effect of an inhibitor?’ Jake offered.

‘That’s one of the general lines of enquiry.’

‘Are there any initial findings back from the out-sourced research programmes?’

‘A couple of early-stage ideas. One is looking at the unusual suppression of antioxidants in TP’s body when red blood cells are broken down. This results in a lower than expected release of bilirubin via the spleen into his bloodstream. The second concerns the low levels of uric acid released when purines are being broken down by TP’s liver.’

‘Surely there are supplements available to help treat either of those conditions?’

O’Rourke looked at him. ‘Don’t you think that was the first thing we tried amongst many treatments?’

Jake nodded. ‘Sorry.’

‘TP’s metabolism rejects anything which isn’t produced within his own system. Hence the research projects being spread out across the scientific community to try and establish an efficient and reliable course of treatment.’ O’Rourke looked away from Jake back to TP’s chamber. ‘Before it’s too late.’

‘Let’s hope so,’ Jake added.

A lengthening silence settled around them. It allowed the background noise in the theatre to rise and fill the void. Monitors bleeped. Staff spoke in hushed tones. Mechanical equipment whirred. Softened footfalls padded.

Jake watched TP. His unique body prone and suspended in an icy chamber. Attached to the world through manufactured tubes and electrical pulses. Jake couldn’t help imagining a comparison between TP now and when he first appeared in this world. This is what TP was fearful of, Jake thought. He recalled their candid conversation only yesterday. Jake looked at his ward’s body lying in an embryonic state. *“I would just like to take my chances with mortality. Same as everyone else.”* He heard TP’s words fresh in his mind.

Jake shivered. Possibilities flitted through his mind.

O’Rourke turned to him. ‘Cold?’

Eager to leave the theatre Jake latched onto her suggestion. ‘Yes. A touch. I didn’t exactly come dressed for the surroundings.’

‘Okay. There’s nothing more to see anyway. Best leave TP in our capable hands for now. When he’s recovered, we’ll leave him in yours.’ The sister turned away. ‘Nurse Arthurs can dispose of your scrubs,’ she added and moved off.

Jake left quietly. He felt uncomfortable looking at TP as an object. Feels more akin to a research lab than a compassionate theatre, he thought.

Without a word Jake took off his scrubs. He balled them up and handed this over to Jayne. He nodded to her in appreciation.

In a pensive frame of mind he hurried through darkened corridors and left the Centre.

*

Jake sat in his office. It was three days since he had been in theatre. After a further restless night of dreams and waiting for a call in the early hours which never came, he felt exhausted. Slumped in the leather chair Jake mulled over TP’s more recent case histories. He didn’t know what he was looking for. He was sure if there was anything incriminating or valuable it had been carefully removed.

He had returned to work the day after witnessing TP’s resuscitation process first-hand and checked with Jayne on his patient’s state of recovery. She assured him there was nothing to be unduly concerned about. This raised his suspicions and only made him more anxious.

A light tapping sounded on his door.

‘Come in. It’s open.’ Jake turned to face the doorway.

Jayne stepped into his office. ‘I hope I’m not disturbing you?’

‘Hello Jayne. No, you’re not disturbing anything.’

‘You won’t uncover anything in those that they don’t want you to find,’ Jayne pointed to the files in his lap.

‘Thanks Jayne. I’d already figured that one out after Sister let something slip in theatre.’

‘What did she say?’

‘Something about TP suffering “some short-term memory impairment”. For that I’d probably read minor brain injury or cell damage. I can’t find anything in TP’s medical notes to match it with.’

The young nurse’s face turned paler. She looked away.

‘What is it? Here. Have my seat.’ Jake stood up and ushered Jayne into the chair. She sat down.

‘It’s partly why I came to see you.’

‘Why? What’s happened? Is it TP?’ Jake felt his stomach drop.

‘TP is out of the resuscitation chamber. He is in post-resus recovery but there were a few complications.’

‘Such as?’

‘He’s not made as full a recovery as was expected.’

‘Is this to do with what O’Rourke let slip? The failure of the antioxidants to suppress the oxygen free radicals?’

Jayne looked at him blankly. ‘I’m sorry Jake, I don’t know anything about that. All I have been told is that TP sustained some cell damage within his brain cortex during the resuscitation process. I’m sorry. That’s all I know. I thought you’d like to know too.’

‘What? When? Whilst I was there?’ He asked in a flurry.

‘Apparently the damage only came to light once the resus process had run its course. By then it was too late to try and reverse it,’ she said. ‘I’m so sorry Jake.’

‘Can I see him?’

‘He’s in the Isolation unit. Sister’s only allowing post-resus medical personnel in for the time being.’

‘Oh.’

‘And in case you’re thinking of visiting on the quiet there are two rather large orderlies guarding his door. It wouldn’t be wise without Sister’s permission,’ Jayne advised.

An awkward silence settled over the office. Jake moved to the corner. The realisation of TP’s condition started to sink in.

Jayne shuffled in her seat. She looked as though she was deciding whether to add something further. ‘There was another not wholly unconnected reason for coming to see you.’

Jake looked over at her. ‘There’s more?’

Jayne sat forward. ‘Has anyone mentioned the name of another clinic to you? “The Harvey Clinic”? It’s the Centre’s partner establishment in Chelsea. Just off the Kings’ Road?’

‘Can’t say they have. What’s it got to do with TP’s situation?’

‘Directly, nothing. Indirectly, everything. It’s connected to what happened to TP in resus.’

‘I’m not in the mood for cryptic clues Jayne. In plain English please. What are you trying to tell me?’

‘Okay. This is just for TP because I like the old guy.’ She composed herself. ‘The Harvey Clinic treats the well-heeled for depression, drug abuse, psychological problems, materialistic addiction. You know the sort of thing?’

Jake nodded.

‘It’s where all the money and celebrities go to “get better” once their excesses cannot be glossed over or kept hidden from the tabloids anymore.’

‘Never heard of The Harvey. Sounds more like a members’ only club. There’s nothing new there. Victorian sanatoria and society opium addicts went hand-in-hand.’

‘It’s a very well-kept secret. The Harvey offers treatment by exclusive invitation. I only know of its location because I worked there on secondment for a week.’

‘It’s connected to here. So what? How does an upmarket clinic treating rich kids link to TP?’

‘The Harvey offers a pioneering treatment which is something of a “miracle” cure.’

‘Go on.’

‘That miracle cure is a direct result of studying TP’s condition. The research and treatment carried out here has led to a very effective therapy for all kinds of depression and addiction-related conditions.’

‘How?’

‘The therapy puts the recovering patient through a modified version of what TP has been going through.’

‘What?’ How does it work?’ Jake felt a mixture of anger and intrigue. He let the idea sink in for a couple of seconds. ‘Why are you telling me? I’ve no influence here.’ His sudden defensiveness, a reaction to past events.

‘I think you’re different. I’ve seen you with him. You seem to genuinely care about how he’s treated.’

‘How do you know I won’t go straight to O’Rourke?’

‘I don’t. I’m leaving soon anyway. I have finally managed to get a Green Card so I’m off to the land of plenty and private healthcare. I thought someone else should know.’

‘If I’m to believe what you’re telling me I’ll need a bit more information,’ he said with caution in his voice. Jake could feel the presence of Laura Miles. He did not wish to get ensnared again as the final option for a dying patient.

‘This is only chatter and supposition amongst the nurses. The so-called “Harvey” treatment relies on the patient being…how do I put this? Clinically induced into cardiac arrest and resuscitated after a short period.’

Jake’s thoughts turned to his earlier reading. That makes perfect sense from a medical perspective, and it’s close to my own supposition, he concluded. ‘This was all in the notes. Not in the specific detail of what you’ve just described but cleverly obscured. It was all there. I had even speculated along similar lines,’ he said.

‘What do you mean?’

‘Sister said to me I just needed to look closer. She was right, it was all in front of me in TP’s case notes.’

Jayne seemed lost in his words.

‘From your time at The Harvey did you get any understanding of what they were hoping to cure or alleviate?’

The question seemed to bring Jayne back. ‘I was only on admin duties during my week there. From what and who I saw though the treatment gets results. Mainly in assisting with depressive illnesses. Self-inflicted or otherwise.’

‘Any ideas on how it worked?’

‘Not the specifics but it seems that a near-death arrest and resus procedure makes the patient happier,’ she replied. Jayne glanced at her watch. ‘Sugar. I have to go.’ She rose from the chair. ‘I’m still on shift. I’ll be missed if I don’t get back. Please don’t mention this to anyone. I’m relying on you Doc.’

For what?

The nurse left his office.

‘You can count on me. I hope,’ he said after her.

Jake reclaimed his seat. Jayne had left him with more on his mind than just TP’s current condition. He started to consider not only his own but TP’s immediate future. Both it seemed had become inexorably entwined. He started to question why he had been employed at the Centre and what his expected duty might be in relation to his only patient. Jake felt he had been invited into someone else’s story without script or direction. Worse still, the intentions of other players seemed dubious at best.

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Jake was kept informed on TP’s condition. Apparently it had not improved in the days following his conversation with Jayne. Rather than sit in the basement of the Centre he decided to work from the comfort of his own flat. Jake got the feeling that his presence at work was neither required nor desired for the moment. He sat on the floor of his apartment surrounded by opened medical books, TP’s case notes, his own journal and a netbook. His concentration wandered. The Centre has closed its ranks with me firmly on the outside. I suppose when they need me I will be summoned back.

Jake had made notes on his conversations with Sister O’Rourke and Jayne. He used key words and phrases based on these to search within the medical and scientific literature. Fortunately, he was still able to log into the electronic library portal from his previous post to access the full range of academic databases. All away from the Centre‘s gaze. Maybe I’m just being paranoid, Jake thought as he trawled through the repositories of accumulated medical research knowledge.

Despite this incredible resource at his fingertips Jake had not been able to get any further with his understanding of what was currently happening to TP. He searched through word

combinations of “Post-Resuscitation”, “Antioxidants”, “Cardiac Arrest” and “Oxygen Free Radical/s” along many other relevant and associated terms. The results provided a bewildering amount of material. Jake had configured the searches to consider only the last five years. It seemed that TP had been diagnosed with his condition in the last seven. He counted on a time lag of at least two years between initial diagnoses and any relevant academic material being published.

Eventually just two promising research articles emerged from the plethora thrown up by the various databases. These were entitled “Post-Resuscitation Care” and “Implications for the Care of Patients”, both published courtesy of the *Horizon Research Foundation*. These articles provided him with at least some answers. They inevitably led to even more questions. The first paper filled in some details which surrounded the “cooling” treatment approach and how this could help patients recover from cardiac arrest. The latter considered the possibility of mimicking the potential biochemical changes caused in the brain when cardiac arrest patients *experienced* a so-called “NDE” or “near-death experience”.

Jake was unable to locate individual authors for these articles – only the organisation which published them. He made a note in his journal to contact the *Horizon Research Foundation* at some point. For the time being though I might have to reconsider what O’Rourke and Jayne told me about the research. At least the science seems to be credible. Still not sure of their intentions towards me however.

He felt pleased with himself as he started to make progress. Deep down Jake knew what he needed to do. Maybe this is even expected of me. Maybe this is why I have been brought in. Parts of the research he had located made it all the easier to justify any potential action. Certainly to himself if perhaps not anyone else. All the work in those papers may have been published on the back of experimenting on TP. Or one of the other unlucky souls O’Rourke mentioned in theatre. I wonder if I can even trust Jayne?

Jake rubbed his eyes. He stretched his neck and shoulders. Time for a break. He stood up and stretched some more. He walked around his flat. He stopped and looked at himself in the hallway mirror. About time for a good clean up. He ran a hand over his unshaven face and frowzy hair.

‘Whether or not TP is well enough to see me I’m going to visit him,’ Jake said with a newly found determination. ‘Someone needs to assess his state of mind. It’s supposed to be my job. It’s my right to be there. To be with him.’

He walked back into the living room and turned the main light on. He closed each of the four curtains around the room in turn. He stopped and shivered. Jake wondered about TP and what he was going to say to him.

*

The next morning he approached the Centre's reception area. Jake half-expected to be forcibly stopped from entering the building. With his head down he hurried on.

'Dr. Balfe?' the receptionist called out.

He recognised her. She had issued him with his ID card a few weeks ago. Here goes, Jake thought. So much for keeping my head down. He walked across to the desk.

'Dr. Balfe? Sister asked me to relay a message to you,' she said.

Jake turned and tried to look as relaxed as he could. 'Sorry. I was miles away,' he lied.

The receptionist looked at him.

She's not stupid. She can see I'm lying.

'Sister O'Rourke said that your patient is out of Isolation now. And if you were to make an appearance today. *Which you have*. That it would be fine for you visit him. As long as it was before two pm.'

Jake looked surprised. 'Okay. I think I can manage that. Where can I find the patient if he's been moved?'

The receptionist looked down at her desk. She rifled through some papers. 'You will find him in Recovery Room EW3.3.'

'Thank you,' Jake doubted he was heard. The receptionist had already moved away and was engaged in another conversation. He continued on across the entrance foyer and down to the basement.

Two hours later Jake was standing outside the door of Room EW3.3. He spent the early part of the morning looking through his journal notes and research material from yesterday. Just so he could get things straight in his head. After three cups of strong coffee he decided it was time to visit his patient.

As he waited to enter the TP's room he thought about Sister O'Rourke. How did she know when he would return to work? Since the first day of his arrival at the Centre, O'Rourke was never that far away from where he himself was. The sister seemed to be able to pre-empt his every move. This unsettled him.

Jake knocked softly and entered the room. TP was sat up in bed. His eyes fixed on a wall-mounted flat screen television. The gentle hum of electronics the only perceptible noise. The room looked very comfortable with picture windows on two sides and pastel shades on the walls. There were flowers in a vase and fruit in a bowl. Two small monitors silently displayed TP's blood pressure and heart beat.

The television volume was muted and the subtitles active. There was a generic property-buying programme on the screen. TP watched the images. His lips moved as he read the text. It was clear to Jake that TP was fully engaged in this programme. This presented a different picture from that of the irreverent intelligent man who had first greeted Jake less than three weeks ago. What have they done to you? Jake started to feel his anger rise.

He approached TP's bed not sure what to expect.

'Hello Jake or Dr. Balfe or whoever you are today.' His eyes did not leave the screen. 'Sister said you might be in to visit me.'

'Oh. Sister does seem to know everything.' He checked his rising temper. 'Forgive my manners. Hello TP and how are you feeling? See you've discovered daytime television then?' He tried to make light of the situation.

'I'm fine. So they tell me. Had a bit of a set-back but you must know all about that. Can't remember a thing about it.' TP looked between the screen and Jake.

Unsure of how much he should tell TP about the post-resuscitation procedure he had witnessed, Jake skirted the issue. 'What can you remember? Before? After? Anything?'

TP turned slowly towards him.

Jake imagined he could see the thought processes taking place behind TP's eyes.

'I can remember talking to you vividly. Our frank conversation. After that it is all just a blank. The next memories I have are waking up here with the television on.' TP seemed confused.

'You realise that conversation took place nearly six days ago?'

'Was it?' he sounded unsure of himself. 'I honestly cannot remember anything of the last six days then. That's not good. Is it?'

'No. It's not.' Jake didn't know how to re-assure his patient. 'Does "The Harvey Clinic" mean anything to you?'

'I don't think so. Why?'

'No matter. Someone else mentioned it that was all.' Jake felt awkward.

TP looked back to the television set. 'Although I do remember the promise you made to me as though it were just yesterday.'

This caught Jake off-guard. It took a moment to process what TP was talking about. "I'll try to not let you down in the same way" – Jake silently recounted the exact wording. 'I remember too.'

TP turned to face him. 'That's good. I thought you might have come down with a case of selective amnesia,' he said with a wry smile. 'Although that seems to be my department now.'

Jake looked over at the television.

‘I’m counting on you Doc. Next time I do not want to wake up in front of this thing. I don’t want to wake up at all.’

Jake nodded. Yes, TP. I’m aware of what I have to do, he admitted to himself.

‘It’s not just the last five or six days I seem to have lost this time. I can’t remember anything prior to coming here. To this velvet prison. I can sense there are valuable memories somewhere there but I can’t recall any of them. My mental capacity seems to be deteriorating fast. This is the “spiral effect” you talked about isn’t it?’

Jake nodded again. And it seems to be in full irreversible flow.

‘This is my choice. It’s my right to make that decision. I want out. Out from this life. Is that clear enough for you?’

Jake looked TP straight in the eyes. ‘Yes.’

‘Good. I’m glad that’s cleared up.’ TP turned back to the television programme. He seemed to instantly reconnect.

It was as if the conversation between patient and doctor had never taken place. In moments of quiet contemplation Jake would revisit this scenario and often wonder whether the conversation had ever happened.

Jake realised his visit was over. ‘Goodbye for now TP. I’ll come back soon to check on how you are feeling.’ Jake didn’t know what else to say. He felt it should be in keeping with a normal doctor and patient relationship. Without any reply he left the recovery room.

Lost in thought Jake drifted out of the east wing back towards the central staircase.

‘How did you find TP’s state of mind?’

Jake jumped in surprise unaware of anyone else near him. He spun around at the head of the staircase. Sister O’Rourke stood immediately behind him. It was as though she had appeared out of thin air.

‘Sorry. I didn’t mean to alarm you. You need to watch yourself on those stairs. I tried calling after you as you came out of TP’s recovery room but you didn’t seem to hear,’ she said.

Jake took a couple of seconds. ‘I didn’t realise anyone else was around. I must have been thinking about TP.’

‘I’m always around here somewhere.’

Jake displayed a faint smile. How true that was.

The sister stepped back a pace and appeared to give him the once over. ‘Are you feeling okay? You look a bit pale?’

‘I’m good,’ he replied. He gathered his impressions of TP. ‘Physically TP seems in good health. Mentally I found him a bit distracted and withdrawn. This would probably be about right for someone who has been dragged back from the brink of a peaceful end.’

Jake caught a fiery glimpse in O’Rourke’s eyes. She seemed good at keeping her emotions in check. Unlike me, he thought.

‘Yes. TP’s lucky to have such a dedicated team looking after him. Although I’m not sure he would agree with your imaginative description of his resuscitation.’

He caught himself before he managed to dig any deeper. ‘Sorry Sister. Bad judgement. You’re right. I am feeling a bit drained. I think it must be the stress from the other night. It was quite an emotional event to witness.’

‘Hmm. Yes. It is quite something to comprehend for the first time. After that it becomes just a procedure. Like any other emergency. I would have expected that life and death decisions were common enough for you?’

‘I guess some of us never get comfortable with reminders of our own mortality. At least with the mind there’s always a second chance.’

‘Unless you’re lucky enough to be treated here,’ O’Rourke said, with a fleeting smile.

If you’re that unfortunate you mean.

An uncomfortable silence settled between them.

‘I must be going,’ Jake said. ‘I should really write up my conversation with TP whilst it’s still fresh in my mind.’ He stepped onto the staircase.

‘Just before you go.’

Jake hesitated. He turned back. ‘Sister?’

‘Because of TP’s emergency your duties on the medical cover rota were postponed. Now he’s out of any immediate danger you will be on your rounds from this evening. Will this cause any problems? Girlfriends? Boyfriends? Dinner dates?’

‘No. None of those fortunately. That will be fine.’

‘Good. You start from ten this evening. Nurse Arthurs will fill you in on any details you need. I wouldn’t imagine there will be a great deal to do. But just so you’re fresh it might be best if you finish up here and get some rest.’

‘I might just do that. After I’ve finished those notes.’

‘Good.’ O’Rourke walked around him and down the stairs. ‘I’ll make sure Nurse Arthurs knows you will be on duty.’ She left the staircase on the next floor and disappeared from view.

In spite of her physical absence an uneasiness hung over Jake as he made his way to the basement. He wondered how much she knew about his conversations with Jayne.

*

‘Two in the morning and all’s well,’ Jake whispered. He strolled around the Centre’s dimly-lit darkened corridors. His footsteps the only obvious sound. It had been a while since his last official night shift. He’d forgotten the feelings of solitude and calm which pervaded a building during twilight hours.

He had arrived at the Centre to discover Jayne was the other night attendant. Jake wondered if O’Rourke had put this in place to see what would happen. He asked Jayne about the sister. He voiced his suspicions. Jayne said that O’Rourke was one of the main reasons she wanted to leave. The others being financial security and a much better lifestyle. At least she was being honest, he thought.

Jake walked up the central staircase. He felt a vibration in his pocket. For a moment he thought that he had forgotten to leave his mobile in the office. The sister enforced a policy of no mobile phones on wards. He remembered the pager Jayne gave him. He clicked it to acknowledge the alert. Milk and two sugars with any luck. Jake quickened his pace. He reached the next floor and dialled “100” on a house phone.

‘Hello. Dr. Balfe. I was paged?’ Jake wasn’t too sure who would answer.

‘Hello Jake. So formal?’ Jayne said.

‘Sorry. Hello Jayne.’

‘Didn’t I mention it earlier? There’s only the two of us on duty. Everyone else is attending a function at The Harvey Clinic. So it will just be me on the other end tonight.’

‘Typical that we’re left whilst everyone else is enjoying themselves.’

‘*Enjoying* is probably pushing it.’

‘I’m sure you didn’t page for a chat however nice it might be to talk to me?’

‘Don’t flatter yourself doctor.’ She paused. ‘Are you anywhere near EW3.3? TP’s recovery room.’

‘Yes. I’m over in the east wing. On the floor below. Why?’

‘It’s probably nothing. I’m picking up an intermittent fault from the monitoring equipment in there. Would you mind having a look and I’ll meet you in a couple of minutes?’

‘Is everything okay with TP?’

‘Don’t see why not. Probably just a loose connection. It often happens. I’m leaving now.’

The line went dead. This only compounded Jake’s unease. He replaced the receiver and raced back to the staircase towards EW3.3.

Jake approached the recovery room. A deep static-noise pulse and a high-pitched beep came from within. The door was wedged tight. With a short run-up he forced his way through. The two distinct alarms intensified in volume.

He turned the room lights on. TP did not stir nor show any signs of consciousness. His breathing appeared shallow and quick. Jake looked for the source of the alarms. He disabled the audio outputs on the monitors. His hearing felt numb as the alarms ceased. Those wall connectors have been dislodged on purpose. In the quiet his hearing returned. TP's breath rasped rapidly in and out. Jake looked at the monitor screens. Blood pressure was forty over seventy and falling. Heart rate was one-hundred and fifty bpm and rising. He knew TP was in serious trouble.

Think, think. Jake forced himself to concentrate. Classic *Ischemic* conditions. What's most likely next? Cardiac arrest won't be too far behind. And once in arrest whatever special qualities TP's body possesses won't help him, he reflected. TP's only hope was to be transferred back to the medically controlled environment of the resuscitation chamber, to cool his core and lower his brain temperature. Alternatives? Think. No resus chamber. What else is there? His mind worked through possibilities. He couldn't come up with any obvious ones.

In a moment of clarity, the layout of the east wing now made sense to Jake. TP's living quarters, recovery room and resuscitation chamber all situated within a few minutes of each other. But with no help to carefully prepare and move TP to the resus room, it might as well have been in China.

Only a matter of seconds had passed since Jake entered TP's room. As time seemed to slow, Jake's faculties quickened. Where was Jayne? He trusted her but something did not quite ring true. He found himself as a junior member of the medical staff in sole charge of the Centre's most prized asset, with just a despondent nurse for back-up whilst the rest of the organisation attended an off-site function.

After his initial medical assessment of the situation Jake took a step back. He considered this was perhaps the opportunity TP had wished for.

Without debating the ethical position Jake knew exactly what he was going to do. Deep down given the opportunity he would always follow a course of action which would lead to the same outcome.

He glanced around the recovery room. His patient appeared in as comfortable a position as a person could be in cardiac arrest. 'This time it will all be over, TP.'

First thing. No-one needs to see what's happening in here. Jake tried to close the door but it needed a forceful slam. It shut but didn't lock. He had broken the mechanism earlier. That will do, less suspicions raised if the door is free to be opened. Jayne should be here by now. Maybe she had no intention of coming? No matter. It's just down to me.

He thought for a few seconds and looked around the recovery room. Jake didn't wish to be suspected of a "mercy killing". Once was enough. How can I make sure TP's body is incapable

of recovering without my direct interference? Think Jake, think! If the main resus procedure for TP's care had been to cool his body I need to encourage the reverse of this, he theorised. I could speed up the onset and severity of Reperfusion Injury to a point even TP's body couldn't cope with. A substantial rise in temperature might be enough to set-off a cumulative increase in the activity of oxygen free radicals. That might just work, Jake thought.

'No-one is coming to save you. Are they TP?' The Centre was done with their star attraction after your last resuscitation. They drained every last bit of clinical information and experimental data they could from your unique body. But none of that matters now.

Jake figured out exactly how to trigger a rapid temperature increase. He searched for the heating control of the ceiling air-conditioning unit. He found it wedged behind TP's metal-framed headboard. He pushed the upwards arrow to the highest temperature available, heard the unit open and felt hot air blast out into the room. His mouth and lips started to dry. Jake then set to work opening up the valves on the room's cast-iron radiators. These were controlled from a wall-mounted thermostat high above the door. He reached up and turned the dial to maximum. Jake turned back to TP and waited.

TP's respiration had become so faint Jake wasn't sure whether his patient was still alive. He approached TP and picked up his hand. He felt a weakened and erratic pulse. Jake held on tightly. The last of TP's proud life sapped away.

'A few more minutes and there will be no coming back. I told you I would keep my promise.' He sat down awkwardly on the edge of TP's bed. Jake felt light-headed. He sweated profusely. This wasn't part of my plan, he thought. The dry heat in the sealed room quickly built up. The combination of the warmth from the radiators and the super-heated air from the conditioning unit rapidly created an arid, inhospitable environment. Jake realised his body was in trouble as it struggled to maintain its own equilibrium. He could not stop himself as he toppled from the bed, banging his head against its frame on the way down. He landed heavily on the floor and lay there unable to move.

His last memories of the events that early morning were of Jayne and Sister O'Rourke lifting him to his feet and dragging him out of TP's room.

He was sure he heard the sister congratulate him on a job well done just before he passed out once again.

**

A week slipped by.

Jake spent the first three days in a solitary room drifting in and out of consciousness. Sister O'Rourke and Nurse Arthurs had been his angels. From snippets of overheard discussions and brief exchanges Jake learned that TP was gone. The proud elderly patient did not survive the young doctor's intervention. The young doctor had come very close to not surviving it either, according to Jayne.

Jake discharged himself as soon as he could walk unaided. The best place for him to recover, he reasoned, would be at home and away from the environment which had nearly finished him.

All day he watched television to forget. The irony of this and his last meeting with a semi-coherent TP was not lost on him. During sleep, glimpses of that early morning came to haunt him. As the intensity of these heightened memories began to fade tangible events came into sharper focus. He was certain that the whole episode had been elaborately staged. Him unwittingly the pawn in a deadly and calculated charade.

Seven days after the event Jake decided it was time to demand some answers. Clearly no-one was in a rush to explain what happened or to ask him for an explanation.

*

Jake approached the Centre. He noticed the brass plaque was gone. Only a rain-streaked rectangular outline remained. He continued down the path and was met by a team of removals' men carrying an assortment of items. Under a waterproof covering he recognised one of the objects. The leather captain's chair from his office. It looked like his services were no longer required.

He hesitated, unsure about going any further.

'Dr. Balfe! Jake!' a voice called from near the entrance further down the path.

He struggled to see through the parade of brown-coats laden with furniture and medical equipment. 'Hello?' Jake offered.

'Jake. Are you coming in out of the weather or what?'

He recognised Jayne's lilting tones and smiled. He was surprised at how pleased he was to hear a friendly voice.

'As you can see, everything is on the move,' Jayne said.

They walked down to Jake's former basement office. Every so often another piece of the CLE was being uprooted and carried past them.

'Where's it all going?' Jake was a bit perplexed by the whole scenario.

'To the Harvey of course. Along with all of the staff.'

'All except you?'

'All except me. Yes.'

‘Do you regret it?’

‘Regret what?’

‘Leaving,’ he replied. ‘Why? Is there anything else?’

Jayne stopped walking. Jake followed suit. She looked at him straight in the eyes. ‘I had no idea of the extent of their plans. Nor how much you were being used. You have to believe me,’ Jayne implored. ‘If I’d known the full picture I would never have let you get sucked in as deep as you did.’ She looked away.

‘Who was pulling O’Rourke’s strings?’ His gaze never left Jayne.

‘I’m just a staff nurse. We have no dealings with commercial managers or directors. I guess it would have been someone high up. Even the managing director herself. Who knows?’

Jake looked around him. Even in the absence of the Centre’s staff he still had the uneasy feeling of being watched. ‘Was it just about money?’

‘Money and scientific prestige I suppose. The Harvey Clinic is the golden egg. TP was the goose. To them he was no more than an experimental research investment. But don’t forget he was a willing partner in all of this.’

‘Partner?’

‘You don’t think the old boy was doing it for the love of science?’ Jayne had a smile on her face. ‘TP had a large extended family. He made sure that they will all be well looked after. He even set up his own medical research foundation. That stands to benefit handsomely from his share of any future research earnings generated by The Harvey.’

Jake took a while to process this. Had he been played from both sides? His expression lay somewhere between confusion and annoyance.

‘TP was no angel. He entered into it all with his eyes firmly wide open,’ she added. ‘He lived like a king here.’

‘In a gilded prison.’

‘He knew his own mind. And he knew it was time to go.’

Jake looked crestfallen. ‘Even my patient had more of an idea of what was going on here. Was I the only one who didn’t know what was happening?’

‘Would you have acted differently if you’d known?’

‘Yes,’ Jake stated without hesitation.

‘I’m afraid there’s your answer.’

There was no more to say. He accepted Jayne’s explanation and his unwilling bit part as a necessary evil. Once again it served only to remind him of his own naivety.

The silence lasted only a couple of seconds. Then the past was the past.

‘Do you need to collect anything personal? As I wouldn’t leave it too long,’ Jayne said. She pointed to the laden-down brown-coated men coming out of Jake’s former office. Just ahead of where they stood.

‘Yes. A few books and files.’ He smiled at her. ‘I suppose this is goodbye. When are you off?’

Jayne looked at her watch. ‘My flight leaves in four hours. I was just heading down to Heathrow and thought I would stop in for one last look. And to collect a few mementos.’ She patted her coat pocket.

‘I see. Not one to hang about then?’

‘No point. Nothing for me here anyway. All my family are over in the States. Now I can join them.’

‘Well. Good luck I guess.’ He offered his hand in a formal gesture.

She looked at it and smiled. ‘Come here.’ Jayne embraced him in an affectionate hug. ‘That’s better. And thank you again. You will never know what a selfless act that was,’ she whispered.

Before Jake could react to her comments or show of affection, she released him, turned on her heels and briskly headed up the staircase. She was gone.

Jake felt confused. He doubted he would ever learn the whole truth. He shook his head and walked into the office to salvage what he could.

END

‘A Common Thread’

A Common Thread

A LOUD, repetitive banging rang out. I sat bolt upright in bed.

'That wasn't a good idea,' I mumbled. A furry tail blurred into the distance.

There it was again. I wasn't dreaming. There really was someone intent on breaking down my front door. My head felt heavy. Sore too. My mouth dry, fur-lined.

I struggled out of bed and stumbled into the hallway. Pulled a coat around my shoulders and proceeded down the stairs. The rhythmic beating continued.

In between rounds I unbolted the door and dragged it open. A huge balled fist was already on its descent. The mid-winter sun shone low through treetops blinding me to its owner. A chilled salt-laced breeze brushed my face. Staring up I struggled to see any features in front of the glare and behind the bare knuckles. From experience I primed my response with a deep breath and stepped back out of reach.

'Good. Glad you're up. Even got your coat on. John said you'd be prepared for anything,' boomed a robust Kentish voice.

I gaped like a freshly landed cod on the South Quay. Devoid of words my mouth continued to make the movements.

'Can't keep them waiting. Come on.' The resonant voice was very persistent.

'What? Why? John who?' I managed.

The cause of my rude awakening was halfway to his white van—a rental—and out of earshot of my feeble questions.

'Who the hell are you? What do you want?' I shouted after him. My demands loitered in the colloidal space between us.

The man turned around. He seemed to give measured consideration to my outburst. Then he smiled. 'I'm sorry Judith. Weren't you expecting me?'

The familiarity was unsettling. He started to walk back. I moved further inside the doorframe as if it offered some magical protection. His features were now more evident: tall, late fifties, unshaven with sandy hair.

'No.' I offered a delayed reply. 'I don't have a clue who you are, how you know my name or why you'd be trying to break down my door.'

He seemed taken aback by my undisguised hostility. I studied him from the dusky hallway of my sail-maker's cottage.

'I apologise for any distress I've evidently caused you.' The voice sounded contrite.

He was hard to read. I stood my ground in silence. Unwilling to show any emotion other than contempt.

‘John...Professor Eustace gave me your address. Before he left on his research trip. I presumed he told you all about me and that I’m, well...a bit unpredictable?’

Sodding professors. They’re all the bloody same. So self-centred. This made me even more furious. I let the anger subside. A deep breath helped wash the frustration from me. ‘Professor Charles,’ I stated.

His eyes brightened. ‘Correct. And you definitely are Judith Catchpole?’

‘Yes.’ A brief grin escaped.

‘Pleased to meet you. I’m sorry we’ve not met but John must have explained that I’ve been busy finishing up at the FSS. The Forensic Science Service. Yes?’

‘Likewise. Professor Eustace did mention something about it yeah,’ I replied. ‘Before he disappeared off on his “sabbatical”.’

‘His description of you—Celtic genes and traits to match—was pretty accurate. He warned me that you would be a bit put out. I suppose I’d be annoyed too. That’s the life of a research assistant I’m afraid.’

I glared at him. And I was just warming to you.

The professor must have caught my reaction. ‘Sorry. No offence meant,’ he added.

Maybe I believed him. Maybe I didn’t. Roll on Easter.

“Arek. Arek.” We both looked up. A juvenile herring gull flew low overhead. Its black wing tips prominent against the cloudless sky as it scouted for food.

‘So professor. What do you want?’ I asked. ‘It’s Christmas Eve. You do know that don’t you? Term ended over a week ago. I’m not due to start with Micro-Biology until the New Year. Or has there been a change?’

‘No, no. You’re still with us at MiBi. Sorry: Microbiology. At least until John gets back.’

‘Okay. What brings you here on Christmas Eve then? You’re not about to start singing are you?’

It was the professor’s turn to stare at me. He was probably trying to figure out whether I was being serious.

‘No. I’m not about to start singing.’ He moved a couple of steps closer. ‘I was finishing up at the FSS in Southwark when the whole place received notice of closure. Suddenly time became a pressing issue. And so I was unable to meet with you in person. I’m afraid I find email a poor substitute.’

‘Mmm. I heard about its sudden closure on the news.’

‘Probably about the same time as most of the staff did.’

The breeze picked up. I wiped an errant strand of hair from my eyes.

‘So what’s the connection between me freezing to death, you standing on my doorstep and the FSS?’

The professor’s demeanour shifted a fraction. ‘The work I’d been engaged with at Southwark was the first step in what could have been, and still could be one of the biggest breakthroughs in modern law enforcement. A method to extrapolate determining characteristics from “scene of crime” genetic information, in order to create a physical, behavioural and emotional picture of a perpetrator,’ he proclaimed.

‘That’s part of what behavioural psychologists have been able to do for years,’ I replied. ‘At Psych-Anth. Sorry: Psychological Anthropology, we can offer a very similar analytical approach.’

It was clear I hadn’t quite grasped the significance of what the professor proposed. His look was something close to sympathy.

‘Perhaps. At least you’re in the right area. It’s a promising start all the same.’

There was obviously a lot more to this. It intrigued me. He intrigued me. ‘Okay,’ I offered. ‘What am I missing?’

‘Simulated Personality.’ The professor let it hang there between us.

I waited for him to explain.

‘I have been working on a method which re-constructs an entire “personality” from genetic material.’

‘What? Like in *Avatar*?’

The professor looked at me as a well-tempered uncle might. ‘Not exactly. But a type of avatar all the same.’

I considered this for a couple of seconds. ‘Where does this genetic material come from?’

‘Along with funding and access to their specialist laboratory equipment, the FSS kindly supplied me with a stock of discarded organic material from crime scene suspects.’

‘And it’s not illegal to possess as they are “persons of interest”?’

‘Something like that.’ The professor smiled. ‘John might have to do without you for longer than he bargained for.’

Let’s hope not. There seemed to be no further explanation on offer. The professor had certainly piqued my interest. I was keen to find out more.

The icy breeze that swept in from the mudflats was now a strengthening wind. I shivered. Why am I still standing here half-dressed in the cold?

‘Bottom line is that I need to get to Southwark before they close the FSS labs for the Christmas break. Who knows if and when they’ll open their doors again? Once midday comes that will be it. So if you’re coming you’ve got five minutes. I’ll be in the van.’

I watched him climb into the cab and start the engine. A cloud of black dust mixed with white fumes spat out of the exhaust pipe.

'Sod it. Sounds more exciting than traipsing around the shops on Christmas Eve. Pressies can wait until the sales. I'm sure the folks won't mind.' Must stop talking to myself. People will start to think I'm a bit odd. 'So let them. Buggered if I care.'

With a decision made I rushed upstairs for some warm clothes, ran a brush through my hair and splashed tepid water on my face.

I was out the door and sitting in the van in under the five minutes. I finished the final touches of my daily "pale is beautiful" routine as we pulled onto the London-bound A2. My bones still felt cold. I turned the heater on full, pulled my fleece up over my chin and settled down into the double passenger seat. We passed by the outskirts of Faversham.

Most scientists I was acquainted with were not big on small talk. Thankfully the professor here proved to be no exception. "Thinking" was where our minds were mostly at. Perhaps it was something we overdosed on too.

What started out as a bright clear early dawn had descended into a grey, windswept, squally mid-morning. The gathering cloud mass ahead looked agitated. It soon let us know just how worked up it was. Swollen drops of rain cascaded from the severe skies and exploded against my side window. We pushed on towards the Capital. I could feel the damp and the cold of the outside as it seeped through tempered glass. I loved living on the North Kent coast. In all its madness you never knew what to expect nor what chaos was coming your way.

*

As we drove through the *Elephant & Castle* I instinctively checked my door was locked. Old habits die hard. With signs to the Imperial War Museum on our left we turned into Southwark Bridge Road. The professor pulled the van up in front of a large pale building with a neo-classical exterior on the corner of Union Street. It was hard to tell what was real or fake anymore in this part of South London. The new buildings were constructed to mimic those of classic designs destroyed in the war and bulldozed away in the white heat of the fifties and sixties.

'Progress I suppose,' slipped out. The professor didn't catch my musing. He was out the door as the engine died. Don't want him thinking he's just taken on the simpleton from Seasalter. I gathered my bag and followed him.

After a few paces trailing the professor I stopped and unzipped my fleece. 'London's so ridiculously warm. Even in the middle of winter,' I muttered and hurried on. I was worried I

would lose him. Thankfully he had stopped at the main entrance. He gesticulated with a uniformed official. I caught the gist.

'He seemed a bit of a jobsworth?' I observed.

'Just doing what he's paid to. He says we have less than half an hour to get what we need. The good news is that we can leave the van there. The wardens finished at eleven o'clock.'

'They do have a heart after all.'

'I wouldn't count on it. Apparently they've already got their quota for the day. There is some sort of dispute with Southwark Council and they are "working to rule".'

'Oh. So much for the supposed Christmas Spirit then.'

The professor thrust a badge attached to a thin lanyard into my hands.

'This is a temporary pass. You'll probably need it around here. It's not exactly Fort Knox but they're understandably security-conscious these days.'

'Thanks.' I looked at it briefly and strung the cord around my neck.

Once inside the main doorway, the professor immediately disappeared with the security guard he had been talking to earlier. It was a cavernous reception area. Its high walls adorned with stucco and security cameras. Professor Charles came back a few seconds later dragging a heavy-duty flatbed trolley behind him.

I looked at it. Then at him.

'Exactly what are we collecting?'

'Just what we came for,' he replied.

Nice side-step. Maybe he thinks I'm just being nosey.

'Twenty-five minutes left. We need to get a move on.' The professor strode away from me with the trolley in tow like a faithful hound on a tight leash.

I followed like an obedient child.

We seemed to be travelling for an age. We burrowed deeper and deeper. I could smell and taste the years in the building. This answered my earlier thoughts. It was definitely an original. Being this near to the River there was an inevitable closeness of damp. Mixed into this, a pervading odour of mildew and aromatic chemicals lingered just out of reach. For a brief moment a vivid image sprang to mind recalled by this curious aromatic mix. I was fourteen and at Debenhams in Canterbury. We had gone there, a group of school friends, to see what we could pick up for pennies at a water-damage sale. The department store had flooded the previous week. I remember walking through the washed-out perfume counters and there was that smell. Curious things these memory triggers.

We changed our method of descent. Down at least two more floors in a creaking *Otis* service elevator. We came to a shuddering halt.

'This is it,' the professor exclaimed.

Despite his earlier warning of the levels of security we had not encountered anyone else, either in a uniform or in civvies. In fact the only person we had seen so far was the guard at the front of the building. Strange.

We stood outside a room barely large enough to merit the name. Windowless but well-lit by a series of daylight bulbs. A bluish light was cast over every surface. Most of the space was taken up with a six-foot long, dark hardwood bench. The professor put down the handle of the flatbed trolley just outside the entrance.

'Come on. Time does not stand still for any man. Even a scientist. That security guard was serious.'

'Or woman,' I responded.

The prof flashed me an apologetic smile.

'Or even a woman scientist.'

I may have cracked a smile myself. It possibly materialised as a sneer. Reign it in Judy. They're not all selfish gits you know, I reasoned. I tried to keep my calm. I used to have a sense of humour…but it was beaten out of me. What a depressing admission, I conceded. I let the exchange go and followed the professor into the space ahead.

From inside the room I could see there were a couple of large cream-coloured plastic cubes and a sizeable desktop PC sitting on the bench. That was mostly it. I was mildly intrigued. 'What is all this stuff then?'

The professor stood behind the bench. 'This is what we need to collect or we'll have no research project to work on.'

'Fine. But what is it? Don't forget I'm a woman who works in Psychology and Anthropology. We don't get to play with complex machinery very often.'

Professor Charles looked directly at me. He glanced at his watch. His brow was slightly furrowed.

'Okay. This whole set-up is basically a cutting-edge "gene sequencer". Your left to right we have a DNA microarray for binding and tagging the DNA sample under investigation. Essentially this identifies, fixes and dyes each chemical base such as *Cytosine*—Yes?—with a fluorescent stain.'

The prof looked for confirmation that I understood at least that. 'Yes,' I played along. Interested though.

'So the raw sample of DNA, obtained from wherever is multiplied in a PCR…'

‘Polymerase Chain Reaction,’ I cut in and felt some redress for the earlier exchange.

‘Very good but I assumed you knew that anyway.’

Touché. I smiled.

He nodded. ‘So the often minute and possibly damaged sample is aggressively multiplied to create enough material for us geneticists to work with. Once it has gone through the DNA microarray,’ he patted the first cube as though it were a child, ‘it normally gets passed onto an optical gene or DNA sequencer. However, this second box contains something a bit different, a bit of a breakthrough: A Digitalised Sequencer.’

He may as well have added a theatrical “ta-da” at the end of his sentence. For my part I looked at him vaguely like I understood the significance of his digitalised sequencer.

‘You see for my research, this changes everything and certainly makes my life—briefly our lives—much easier and much more interesting.’

‘How? I don’t quite follow.’ I was genuinely interested.

‘Up until last year, when I received a PCR prepared sample from a laboratory I would run it through the normal stages of the microarray and the sequencer to end up with a list of genetic code. This would then have to be laboriously assembled into the specific genes. Eventually the subject’s entire genome could theoretically be uncovered using this method.’

‘So what does your new box do?’

‘The hardware sequencer organises the three billion or so chromosomal letters in a person’s DNA profile and re-assembles them into their specific genes. Once fully working it may well be possible to digitalise the genome—the whole gene structure—of a subject. This data could be used to assemble that genome into an electronic or digital facsimile of the donor.’

I let this sink in for a moment. ‘You are saying that these machines could reconstruct a person in digital form, from a sample of DNA?’ My head filled with possibilities.

‘There you have it. But my research is only in its trial stages. There are many unknown elements that we, or should I say *I*, have only started to grapple with as yet,’ the professor said.

‘I bet there are.’ I looked at Professor Charles as he stood behind the test bench and felt that someone had just convinced me that the Earth was indeed flat. Even as a non-geneticist I was a bit blown away by what the prof had just told me. One obvious point nagged away though. Why choose me to help with this?

‘Surely there are genetic researchers the world over who would *pay* you to be a part of this? Why enlist my help?’ I could tell the prof was itching to get out of the building. I needed

to know exactly why I was there on this increasingly strange trip, on an increasingly surreal Christmas Eve.

'I'm sure there would be but this research is only in its developmental stages. I've not even started preparing a paper yet, partly due to Official Secrets but partly because I'm not sure where it's going to lead.' The professor looked again at his watch. 'As my official secondment at the FSS has now come to an end with its closure, I've cleared it so I have this equipment on short-term loan for my own independent research project. After that, let's see. Does that cover everything you need to know?'

I nodded at his explanation.

'Good. And if we don't move this soon we'll be locked down here for Christmas,' he added with an air of urgency. The professor started to close the system down. 'To answer your earlier question. Once the digitalised "shell" is in place, it's precisely that, a shell. There is no personality although the personality indicators are always there as part of our genetic make-up. Essentially this shell then needs to be populated with experience, ideas, thoughts and environmental factors. We would need a lifetime's worth of a person's likely or generic experiences to reveal anything worthwhile to us.' He smiled.

Suddenly the misshapen penny dropped. The next stages of the prof's research would probably require inputs from both Psychology and Anthropology. To offer respective insights into the individual mind and the experience of the collective and cultural. I was here to help populate the void in the minds of the professor's avatars. It all made some sort of sense now. I wasn't too sure how I felt about it though. A bit creeped out if I was being honest.

Perhaps months before the professor probably raked over the same logistical and ethical areas which at this moment pre-occupied me. Instead of having any "crises of conscience" he was busy powering the system down and unplugging the equipment. Without any prompting I turned around and dragged the trolley into the compact room as far as I could.

Once the machines had been shut down, we started to load up the state-owned equipment which was great deal heavier than it looked. These machines obviously didn't come in a lightweight version. Even the PC tower felt like it had lead shielding in it. After a bit of co-ordination the prof and I managed to load all the equipment onto the flatbed trolley. We even managed a few extra boxes which had been piled up in the corner of the room. With everything secured we headed back the way we came, as fast as the trolley would move.

With a quick nod from the security guard we carefully packed the equipment into the van and handed back the trolley. With that we were off. Back down the A2 to my beloved Garden of England.

*

Ten-to-three in the afternoon and the gloom had begun to settle outside. I sat in my kitchen surrounded by the encroaching darkness of a mid-Winter's afternoon nursing a piping hot cup of *Earl Grey*. I picked at a bacon butty. Archibald lazed at the opposite end of the rectangular trestle. He had already devoured his fair share of the rashers. His sleek petrol blue fur reminded me of the little old dears from when I was growing up. They would enter the hairdressers on the corner of our road with greying manes and exit with their blue-rinse set perfectly solid, defying the fundamental laws of nature. I stared into the blackened space once occupied by an old kitchen range.

The professor had dropped me off just a little over three-quarters-of-an-hour ago. I offered to help him unload the equipment at the University but he said it was covered. Seemed a bit pre-occupied, so I left him to it. I was glad to get back into the warmth to be honest. The journey back from Southwark had been as uneventful as the journey there. It had been quicker. The traffic had mostly disappeared from the majority of Kent's roads. I'd probably still be stuck in a car park queue at Bluewater. I pondered on an alternative timeline where I had gone Christmas shopping instead.

It was strange that the level of conversation didn't pick up on the way back. Bearing in mind what the prof had revealed to me earlier. But it hadn't. We even resorted to small talk. That's how peculiar it was. What was I doing for Christmas? Did I have any family? Were there any friends expecting me? Any parties or get-togethers? That sort of thing. All about me. I didn't feel comfortable with asking the prof about his plans. Or maybe at that point I just wasn't interested enough to care.

All the way back down the A2 I had been foraging through the ideas that the professor had planted in my imagination. I tried to formulate some intelligent questions to ask. But they wouldn't come. When eventually one did we were on the outskirts of Whitstable, so I left it. The professor had skilfully evaded any detailed discussion of his research with me.

My Chadburns' chronometer struck out the time. The first of the bells jolted me back to the present. My tea was tepid and the bacon from my butty gone. Archibald looked at me with a glint in his eyes and jumped off the table. He licked his mouth as he went. 'Thanks Archie,' I whispered with as much sarcasm as I could direct at a cat. I stifled a yawn.

The spectre of Dickens' Ebenezer hung over me like an unpleasant smell. I decided to give in to a bit of Christmas shopping after all.

'It might help to shake off this uneasy feeling I've got about the prof and his research,' I said to the disappearing Archibald. 'If I'm quick I can catch the three-fifteen to Canterbury.'

I grabbed my coat, scarf, hat and bag, and left for the bus.

**

‘Cheers for the lift Dad and say thanks again to Mum for the great Christmas dinner. Bye, bye. Bye…’

After lots of waving my father Tom was gone. Just a few miles along the coast back to Tankerton. Not very adventurous our lot. But then if you live on the very edge of an island where can you go? It had been a lovely day. Unusually so. A Christmas Day together without drama. Good job I decided to get some presents yesterday afternoon. That probably helped smooth things.

It was late. Possibly even Boxing Day morning.

As I stumbled down the hallway I heard my answer-phone in the kitchen click off.

Who the hell would be calling this late on Christmas night? I reasoned that it was probably my Mother checking that I’d got back safely. I felt a bit sheepish. ‘It’s good you’ve still got someone to care about you.’ A drunken mixture of guilt and self-pity washed over me. It had taken a while but things were finally starting to return to normal with my family. When Rob was here, my parents loved to visit. He always made a great show of welcoming them. I think he was scared that I would say something about his violence to embarrass him if he didn’t treat them like royalty. When it all came out, my mother seemed to blame me. Different generation, I suppose but that’s no real excuse. We didn’t speak for two years although I’d meet up with dad every week for either Thanet AFC or Whitstable Rovers, whoever was at home. Water under the bridge Judy, water under the bridge. Too much red wine is more like it.

An intermittent crimson glow in the kitchen grew stronger as I neared the doorway. I flicked on the overhead light and reeled back from its abrupt illumination. Once my brain and eyes had adjusted to the brightness, I could see the answer-phone blinking with intent from the corner of the kitchen table.

‘Twelve missed calls!’ I was bemused and sat down. ‘That’s not my mother. One or two maybe. Who’s been trying to get hold of me? Today of all days? It’s more calls than I get in a year,’ I burbled to no mog in particular. I saw Archibald out of the corner of my eye. On the hunt for some food I suspected. ‘Hey, Archie. You don’t think it’s Eustace begging me to come on his research beano do you? He knows I’m the one who does all the work on his projects...’ I shouted after the shiny Persian. I closed my eyes. An image of my *ex* flickered in the darkness. I shuddered but shook the image away.

It hadn’t occurred to me to simply listen to the messages. That was too much like hard work. ‘You can wait.’ I directed my ire towards the machine at the end of the table. ‘Why would I want to ruin a perfectly brilliant day?’

I had slumped a bit. I now lay with my head resting on folded arms at the edge of the kitchen table. It crossed my mind to sleep just where I lay. After careful consideration I decided against it. I stood up. Slowly. I headed into the hallway.

The phone erupted into life with an ascending tone. The noise unsettled the night. It sent a jolt straight through me. I stood still for a few seconds in deliberation. 'Sod it. It's well after midnight,' I muttered. 'Whoever it is can wait.' The ringing continued. If they've rang twelve times already I may never get any sleep. I walked back into the kitchen and skirted the edge of the table. I snatched up the handset.

'Hello? And do you realise what the time is?'

'Hello Ms Catchpole. Sorry to disturb you. I tried earlier but you were out. Apologies that it's so late but you've obviously had a good day.'

I couldn't place the voice but something in the manner was familiar.

'Who are you and what do you want?' I felt a mix of anger and apprehensiveness. Is this an official call? Is it the Police, the Ambulance service? Has something happened to my dad? My mind grasped at possibilities.

'Sorry Ms Catchpole, it's me. Professor Charles. Didn't you get my messages?'

I could've kicked myself if I wasn't in danger of falling over in the process. Here's me imagining all sorts. I berated myself for not listening to the messages.

'Professor Charles,' I replied through gritted teeth. 'It's Christmas night. I've been out with my family and have had an uncommonly successful Christmas Day. What do you want?' I could not disguise my frustration.

'I wondered if you were free tomorrow?'

'It's Boxing Day!' I stated with an exasperated lift.

'I can arrange to get you time off in lieu or extra payment. Whatever suits? If you're free that is?'

'As it happens, no I'm not busy but that's not the point…'

'You drive a hard bargain Ms Catchpole. Extra pay *and* time off in lieu. I should be able to swing that for you. Great. I'll see you at the University tomorrow at ten o'clock sharp. I'll meet you by the entrance to the School of Molecular Biology. It's at the other end of the Science Faculty building to Psychological Anthropology. Oh, and a belated Happy Christmas.' The line went dead.

'No professor. I won't be there...' My protestations went unheard. He had already hung up. I was lost for words. Too tired to get angry I decided to go to bed and have a nice long sleep. 'Breakfast at midday I think.' I scooped up the purring Archibald and headed upstairs.

*

I awoke with the sun after a sound night's sleep. Archibald was curled up on the pillow beside me. I smiled. Well at least you're planning to have a lie-in until noon.

After a few restless minutes my mind turned back to yesterday's late-night conversation. I didn't have anything on today and I was curious as to why he found it so important to be working on a bank holiday. In the middle of a semester break. I mulled it over some more.

'I suppose I should see what he's up to. If nothing else it will get me out of the house for a bit. I can always ride back along the coast.' I directed my one-way conversation to the dozing mog.

With my mind made up I crawled out of bed and left Archibald to it.

*

I parked my bike outside the entrance to Psych-Anth. A couple of minutes to spare, that's good. No competition for the undercover areas today. The campus was near-empty save for a few maintenance vans. Even so I made sure my bike was locked. A habit borne out of experience. I walked around the perimeter of the low-rise Science Faculty building. All the connecting passageways and corridors had been closed up for the break.

Just on ten o'clock I came up to the entrance of Molecular Biology as instructed. The Pilgrim Bell sounded far off in the distance of the city. As the last chime struck one of two side doors marked "Emergency Exit" opened. The professor beckoned me in. Yesterday's feeling of unease returned briefly.

I entered into the bottom floor of a stairwell. Once inside the professor closed the door firmly behind me. It was a fairly gloomy space. Unpainted concrete walls and emergency lighting. 'Classy.'

'Glad you could make it. Thank you for being on time Ms Catchpole. Can I call you Judith?'

'Judith is fine, prof.' Familiarity cuts both ways professor, testing him.

'Me prof, you Judith.'

I smiled at his riposte. 'Looks like we've both discovered a sense of humour.'

He returned my smile.

'Where are we working then?' I asked. 'Have you got any fresh milk?'

'First floor, second door on the left. Fresh milk and coffee, or tea if you prefer.' He pointed up the stairs. 'You lead the way. I just have to finish securing the door.'

As I climbed the stairs I glanced back. The professor seemed to be reconnecting security wires to the pressure pads at the top and either side of the double doors. My disquiet lingered. I moved on as directed with the professor now close behind.

We entered a large laboratory teaching space. On one side the wall was mostly plate glass. The opposite was magnolia fibreboard. This had been papered with undergrad instructional posters. These mostly showed graphics of cells containing unravelling strands of double helices complete with sections magnified to reveal the complexities of genetic information. Apart from the odd tray of lab dishes and various *Pyrex* glassware, the over-riding theme of this teaching lab was probably the one thing most in common with all the other labs in the Science Faculty. The dominance of desktops, flat-screens and the occasional printer.

'Go on through to the back. There's a separate office area.'

I hadn't picked out the office at the rear of the lab. The unfurled blinds were beige and mixed in so well with the lab's walls. I opened the door to the office and was immediately greeted by the set-up from Christmas Eve. This time in a slightly larger space. The professor squeezed around me as I stood in the doorway.

'Like a home from home,' he stated.

'For you maybe.'

'We'll see…'

After a brief silence the professor swept his hand before him. 'Come in. Make yourself...at home.'

'Thanks.' I was glad to be able to take off an outer fleece layer. The bike ride wasn't that bad from home to the Uni now the cycle routes had been completed. But you always felt so much hotter than it actually was.

'Good. Take a seat,' the professor pointed to a small settee in the corner of the room.

There was a square table and a chair there too. A laptop, the professor's I presumed sat half-open on the table. I guessed this was a break area for him.

'Coffee? Tea?'

'Tea would be great. Dash of milk. No sugar. Thanks.'

'Right. I'll be back in a minute. Have a look around if you like?' He disappeared out of the lab.

I didn't take up the offer. I stayed put as it was warm and fairly comfortable. And I was still yet to fully disentangle myself from the army surplus shoulder bag which seemed to contain my life these days. True to his word the professor returned with a couple of mugs and a packet of Garibaldis. He placed these down in front of me.

'Thanks,' I offered. 'Garibaldis...haven't seen those in years.' I opened the packet and snapped one off. There was no standing on ceremony when biscuits were involved.

The professor smiled and took one himself. He sat down in the chair opposite and took a sip of his acrid-smelling coffee. He leaned forward. ‘I suspect you are wondering why I requested you in today. On a bank holiday.’

‘Just a bit,’ I replied. ‘To be honest I’m only here out of curiosity.’

‘That’s okay...’ the professor hesitated but didn’t add anything further.

‘I figured on the way over here, that it was unlikely that the FSS would let you remove equipment containing classified and personal information from a secure government building.’ There was no noticeable reaction from the professor. I let this settle for a few seconds. ‘So. One of two things has happened. Either we have just committed a grand theft of government intellectual and physical property. Or the research project you outlined on Christmas Eve has stayed exactly where it was and what you’re working on is something related but different?’ I felt pleased with myself and took a long drink.

The professor stared at me for a short while. ‘Not bad. Eustace was right to recommend you. There is some truth in both your accounts.’

‘There is?’ I felt sick. What have I become mixed up in?

‘Don’t worry. The first one not so much. The Home Office won’t be trying to track you down. The second one though is fairly spot on.’

‘Explain please?’ I managed.

‘With the FSS official project. The one I told you about,’ he said. ‘All the data I had been working with was put into secure storage as soon as the preliminary and restricted notice of closure came through. That was two weeks before the Christmas break. What we “borrowed” the other day was the bare bones software and hardware. Understandably this is quite a sensitive area for the Home Office. They kept a very close eye on me with regards to their data.’ The professor’s voice had a deliberate and measured tone about it.

It sounded like he had rehearsed this short talk more than once. ‘Perhaps they had good reason,’ I retorted. I hoped there was a look of displeasure on my face.

The professor seemed unfazed. ‘With no official data to work with for the last couple of weeks, I decided to introduce some of the material I had been collecting for just such an eventuality. I didn’t think it would present itself so soon.’

‘What sort of “material”?’

The professor looked at me plainly. ‘DNA of course. What else would I be collecting?’

Silly me. ‘Specifically whose genetic material have you been collecting?’

‘We’ll get on to that presently. If you bear with me I can show you.’

If this was meant to placate me it had the opposite effect. Calm down Judy. Calm down. Let the man speak. A few seconds ticked by and my blood pressure dropped. 'Sorry professor. Carry on.'

'Thank you,' he said. 'The unexpected closure was a shame as I was starting to get some interesting results with the FSS project. However for my personal research it presented a real opportunity. With the DNA material the Home Office supplied, I was able to refine a couple of the analytical techniques to a point where I started to generate measurable data. As a result my own work starts from a much higher place on the development curve.'

'Going back to my earlier point. Do you, or *we* I suppose now have official permission to use this equipment?' I gestured at the array of quietly humming boxes sitting atop the lab bench.

'Yes. Although...'

'A straight answer would be appreciated.'

The professor looked at me. He appeared to hesitate. 'Yes. We do.'

I let out a sigh of relief.

'But maybe not exactly from the right people,' he added.

'What does that mean?' I could feel my frustration boiling up again.

'The person in charge of research at the Southwark HQ sanctioned the equipment's use for my personal research, after the workload for the FSS had been completed. He agreed that it could be used off-site for a specified time as long as all the government data remained securely with them.'

'That all seems reasonable. So why all the apparent "cloak and dagger" stuff?'

'Two days later that same head of research was dismissed and paid off. Left the building that day. Escorted out apparently. I wasn't even there to pass on my best wishes. There's to be no replacement. Effectively all the research programmes have been kicked into some very long grass.'

'That government-sponsored lawn must be more like a savannah these days,' I said.

The prof nodded.

'So where does that leave the issue of the equipment? Which you now conveniently have off-site?'

'As far as I'm concerned I have an authorised and signed order. This entitles me to pick up the equipment for use in my research.'

'For how long?'

'I'd like to think indefinitely. However I suppose we'll have to work on the premise that come the fourth of January they may expect it back. With all their research programmes cancelled including my own, there will be no more work on the project in Southwark. So

technically we've got it at least until they ask for it back,' the professor replied. 'Being realistic we should work on the fourth as being our last certain day of research,' he added.

'Why then?'

'That's when they are all due to return from their Christmas break, if anyone is left after the cuts.'

'Okay.' I weighed up the professor's comments. 'So who knows that you have it?'

'The *ex*-head of research and the security guard. I suppose it will be documented on a slip of paper somewhere.'

I felt relieved that we hadn't technically stolen anything. 'Not as straightforward as I would have liked but I can live with it.'

What I didn't impart to the professor was a two-year probation order in my distant past. I could do without any trouble re-visiting me from a desperate and violent time I'd rather forget. The prof didn't need to know any details as long as he was being straight with me. I suppose I didn't have much choice now. I just had to take his word and place my trust in him.

For the next few minutes we sat in settled silence on opposite sides of the office. I suspected that Professor Charles was thinking about how far he could trust me to follow him down whatever path he would reveal. I used some of the time to finish off another couple of Garibaldis along with the rest of my tea. I also took advantage of the quiet to take stock of the professor and what I could believe of his tale.

'Okay,' I said. 'Show me what you've got? If I'm going to be damned by this at least I need to know what it is I'll be damned for.'

A broad smile spread across the professor's face. He leapt out of his chair. 'Good. That's the spirit I'm after.'

We approached the sequencing equipment. I noticed on closer inspection it was all linked together in series with a number of tubes and cables. The professor reached around the rear of each of the boxes and brought them out of standby mode. He stood in front of the desktop PC.

'Like most of the digital lab equipment these days it's best to leave them in standby. They can be a bit sensitive and it saves continuous re-calibration.'

I felt as though I were an undergrad again. 'Not very green though.'

'What is?' he countered. 'If everyone in the world turned each piece of electronic equipment off after they had used it, there would be a massive drain on energy when it all powered up again. The human race has proved an adaptable and resourceful if exploitative

species. When we need to find a solution to the problems caused by our insatiable need for energy we will. But not before then.'

'Don't suspect many of the eco-fraternity would see it quite in those terms,' I observed from a well-worn position on a very wide fence.

'Down to business,' the professor brought the focus back to the matter in hand.

The sequencing equipment came back to life. When the PC's screen flickered on I noticed that there were a number of individual files populating the home page. These were all tagged with an identifying alpha-numeric code.

'As you can see I've already been making the most of my time with the kit. The majority of those files contain results from mock trials and control work based on surplus FSS data,' the professor explained.

'Are we talking the same data which was classified?'

'Yes and no,' he said with a slight hesitation. 'These were never the subject of official trials but did come from willing test subjects that the Home Office supplied. They were only ever meant to be used for blind tests and for calibrating the sensitivity of the equipment. All personal details were removed from the samples. I would have no way of knowing who the sources were. Hence the generic initials: *AA*, *BB* and so on.'

'Doesn't make it any more ethical.'

'Doesn't make it unethical either,' he replied.

Slippery. At least I know the sort of person I'm dealing with.

'Just how did you get this material out of the Southwark HQ?'

'Most of the calibration material wasn't classified at the same level as the test data. There was some leeway in being able to use it off-site.'

I let it drop but not forgotten.

I shuffled around the screen for a closer look and scanned the files. I wasn't too sure what I was looking at. One in particular had different initials: "PC/EC/251216". Its date seemed to relate to yesterday's Christmas Day, two-thousand and sixteen.

'You said "most". What about that one?' I pointed to the file, "PC/EC/251216" on the screen.

'Well spotted, Ms Catchpole. That's the work I started on yesterday,' he answered.

'On Christmas Day. You were working on Christmas Day? That's a bit strange isn't it?' I talked without much consideration of what came out. The irony only registered after I had finished. Up until late Christmas Eve it had just been me, Archie, an emptying bottle of red and some Christmas TV Special for the big day.

‘Not really. I don’t know for sure how long this equipment will be here, so it’s best to make the most of it,’ he said. ‘Anyway it’s my choice. My family understand perfectly. I’m sure they’re having a great time, skiing in Winterberg,’ he added.

I had to wonder whether he was winding me up. My instincts told me the professor was on the level. With this story at least.

I pointed at “PC/EC/251216” again. ‘This has differing initials. So it isn’t one of the non-classified samples then?’ I tried to steer the conversation back to my original enquiry.

‘Correct.’

‘Is this one of your own research samples? One you’ve been saving up for a rainy day,’ I asked.

‘One of them yes.’

One of them? Wonder how many more there are.

‘Who’s the lucky donor? Anyone we know or does it even have an identity?’

‘The subject is a male and went by the name of *Edmond C*. The other initials are my own.’

I nodded in acceptance and waited.

‘Edmond was born in Chester sometime around the turn of the eighteenth century. Seventeen oh-one or seventeen oh-two is my best guess,’ the professor said. ‘Early on he proved himself a scholar and showed an aptitude for the medical and natural sciences.’

The seventeen-hundreds. What am I getting myself into? Where did he get a genuine eighteenth century DNA sample from? Thoughts of grave-robbing flashed into my mind. That would look good on a CV wouldn’t it? I mused. Right up there with my conviction for aggravated assault. I restrained from interrupting the running discourse.

‘He was taken under the tutelage of a prominent physicist, Richard Boulton who had written treatises on medical science, the constituents of “air” and Robert Boyle’s work amongst other topics,’ he paused for breath. ‘Edmond did not go on to have a very distinguished scientific career mainly due to his associations with Boulton. Although he did have a useful medical one and in his lifetime would have witnessed major advancements in the natural sciences. He died in seventeen-eighty,’ he added. ‘So there we have our first test subject,’ the professor stated with a brief smile. ‘An eighteenth century amateur scientist and man of medicine called Edmond C,’ he concluded.

I nodded and tried to take it all in.

‘So we know when he died and roughly what age he was. This means we...’

Specifically me, I thought.

‘...can look deeper into his background and consider the sorts of scientists, artists and natural philosophers he would have mixed with. Your area I believe?’ the professor added.

‘Ahem,’ was all I initially managed as I struggled to wrap my thoughts around all this unexpected information. ‘Yes, very much so. I should be able to provide a general and informed psychological view on particular opinions, thoughts and mind-sets of the day,’ I said, as I grappled to produce something meaningful. ‘On a personal level, there may be some details or records offering insights into Edmond C’s life or perhaps contemporaries of his,’ I added. ‘And there are always the public writings of the day from journals, newspapers, pamphlets and notices. This might be a good place to start?’

‘Good,’ he said. ’And from an anthropological perspective?’

I had just about caught my breath. I was also still a bit apprehensive about using the DNA of an unwilling donor but the professor’s enthusiasm was infectious. ‘Okay. I could certainly research into the cultural backdrops prevalent during the years of Edmond’s scientifically active period. This would indicate the types of societal pressures and influences he and his peers may have been subject to.’

‘You seem a bit hesitant,’ he observed.

‘Yes I’m hesitant. That’s putting it mildly. I’m struggling with the ethical considerations of using a deceased person’s DNA. I mean, where did the sample come from? And how did you even know it would still be usable after all this time?’

The professor looked at me hard for a few seconds. He shrugged, ‘Fair questions I suppose. Although you may not believe me…’

‘Try me.’

‘Fine. From a dealer in Japan. Through eBay, believe it or not.’

Professor Charles offered the tall tale to me like an outstretched hand holding a banana for a naive gorilla.

‘You bought a piece of DNA belonging to an eighteenth century English doctor from the Japanese eBay?’ Incredulity crept into my voice.

‘It’s not as straightforward as that.’

‘Glad to hear it.’

‘A severe gum infection in the eighteenth century could be as fatal as a limb amputation if gangrene was allowed to set in and enter the bloodstream.’

I stayed quiet.

‘This morbid but real fear manifested itself in a small, significant portion of the population. It resulted in some of this group undergoing a procedure that saw an individual’s full set of teeth extracted, healthy or otherwise and converted into a set of dentures. Leaving the risks of the surgery aside, it’s hard to imagine the excruciating pain endured during and after the operation.’

I mulled this over for a few moments. ‘You’re telling me that you bought a set of eighteenth century dentures from a dealer in Japan that just happened to belong to a three-hundred year-old English scientist?’

‘They came with a provenance and a letter of authentication. I believe it to be genuine. The story of how they ended up in Japan, I’ll save for another time. All that’s important is that they are authentic,’ the professor stated.

‘I don’t doubt it. But it still doesn’t explain about the DNA and how you knew it would be viable from a set of three-hundred year-old teeth?’

‘I didn’t,’ he said. ‘There’s no way anyone could know that. I took a calculated risk. Tooth enamel is a good airtight container. Many of the extracted dentures at this time were often coated with shellac and other varnishes, and were routinely maintained. For me this made them a potential source of exploitable historic DNA.’

‘That’s quite a gamble. Presumably you had to pay a tidy sum for Edmond’s dentures?’

‘A sizeable amount. Yes,’ the professor replied. ‘Mind you I ended up buying some spurious items before I happened on these. There are a lot of charlatans out there but I needed to start somewhere,’ he added. ‘My work at the Home Office with their contemporary samples yielded positive results, and so I wanted to see if my hypotheses for testing “period” DNA would do the same.’

I began to get a clearer picture of who I would be working for and on what. Although I didn’t agree with the professor’s apparent lack of ethical concern, as the project was revealed my curiosity grew. This alone kept me from walking out.

The professor looked at me with the inquisitiveness of a friendly uncle.

‘Happy with all that?’

‘Not the word I’d use but I’m intrigued. I think I can certainly add something to your project.’

Even if I didn’t like it there was little choice, I reflected. The stark reality was that I needed the work until Eustace returned. I was concerned by the lack of contact from him. He had been gone for over three weeks now. It was out of character for him to be so silent. I pushed these thoughts from of my mind and tried to concentrate on the professor in front of me. One at a time was enough to be dealing with.

‘Good and good.’ The professor smiled. He walked away from the screen over to the side of the office. ‘That folder of Edmond’s on the screen doesn’t really contain much. I was a bit behind with things yesterday. Maybe we can populate it with something more meaningful today?’

The professor opened a small chiller cabinet and took out a two-inch vial. It contained a blue-tinged cloudy suspension. He carried it over to the DNA microarray.

‘Edmond, I presume?’

‘A replicated sample of his DNA. Yes.’

He carefully loaded the vial into a push/pull tray at the rear of the first machine in the technological triptych. He touched a large green button labelled “Run”.

‘Right. Let’s see if we can get a full sequence going,’ the professor said.

I stood back and watched as he opened up various folders and files on the desktop. The microarray uttered a few mechanical clicks and pops as it went about its task of identifying, fixing and dyeing each of the sample genome’s chemical bases.

‘One question, professor?’

‘Yes?’

He had his back to me.

‘If I’m going to provide some personal context for this “synthetic model” of Edmond C…’—it felt weird to talk of a dead person’s personality as a commodity—‘…then don’t you think I’ll need to know his full name, along with a few more details?’

There was a noticeable hesitation. Punctuated only by the feint electro-mechanical noises from the microarray.

‘Yes. I suppose you do. I have all the details of his life and work in a folder for you already.’

He turned around to face me.

‘There is one other thing and believe me, this is a pure coincidence.’

‘What is?’ I sensed trouble.

‘Edmond’s family name is something very familiar to you: Catchpole.’ The professor let this hang in the air between us.

Did he just say Catchpole? My name. My family name? ‘Did you just say Catchpole? My name. My family name?’

‘Yes. That’s right. *Edmond Catchpole*,’ he said with an air of apology. ‘Obviously science runs in the genes,’ he added.

Levity wasn’t Professor Charles’s strongpoint. Clearly he had not been sure how I would take the news that we were about to start experimenting with the DNA of a potential, if very distant, relative. And by extrapolation, a possible genome closely linked to my own. I wasn’t sure how I felt about it either.

I turned away from the professor’s gaze. What were the realistic chances of him finding a sample with a particular heritage and then finding a researcher available and at the same University, with that same shared heritage? I’d have more chance of winning *El Gordo*, than Charles’s convenient coincidence clicking into place all by itself, I reasoned.

From my own genealogical dabbling, I was aware that Catchpole was a prevalent if not overly common English surname from medieval origins. It had started to become less so in the eighteenth century. As rural workers migrated in their droves to the burgeoning towns and cities, the need for country tax collectors and their enforcers waned.

On balance however, I couldn't discount the most likely explanation was that it simply was a coincidence. A huge one but one nonetheless. If I was called Smith or Black and the same thing had happened I would not have thought twice. Was I being blinded by curiosity and a precarious financial position?

I rotated back to face the professor. He looked expectant. Of what I wasn't sure.

'That's fine professor. Although I can see why you didn't tell me the subject's full name at the start of our meeting. Then it may have produced a different reaction. Let's get on, shall we?'

Professor Charles looked relieved. A fragile smile appeared. 'Thank you for your understanding.'

I nodded an acknowledgement.

Both happy to put the subject behind us, the prof returned to the monitor and I observed his progress.

A couple of minutes dragged by.

'How long will it take to see any results? A day. A week. Longer?'

'The microarray's work should almost be done by now.'

With perfect timing there was an audible clunk and the digitalised sequencer box came to life with a blink of its control lights. Clearly some sort of activity had started inside the sequencer.

'What happens in the sequencer again? I know you briefly explained the process the other day but I'm afraid I tuned out halfway through,' I admitted. If I was going to be part of this research, I was determined to know everything there was about how it worked and why it was happening. A defence of ignorance no longer carried any weight at all.

The professor stepped over to the sequencer.

I followed on behind.

He rested his hand gently on top of the machine. 'The fixed and fluorescent-dyed chemical base genetic material is now in the process of being transferred to the sequencer. This digitalised version of a gene sequencer operates on two levels. Firstly it produces a numerical version of the information it's receiving from the microarray. So instead of working with physical material it can work with digitally encoded data. This has implications for both accuracy and speed. Okay?'

I nodded. So far so good.

'And secondly, once the complete encoding and sorting of a subject's chromosomal base letters: Thymine, Adenine, Guanine and Cytosine is finished, the sequencer then starts to organise the genetic information into a complete genome for that subject. If you like, a virtual genetic replication of that living person.'

I processed the professor's explanation of what was going on. I tried my best to interpret it into a stream of events I could relate to. Finally it all clicked into place. 'So beginning with the DNA sample you extracted out of Edmond's tooth,' I said. 'This has been replicated, multiplied, broken down, its structure investigated and identified. Eventually this data is then used to create a genetic copy of one Edmond Catchpole, the eighteenth century physician, amateur scientist and possible distant relative of yours truly,' I summarised. I felt pleased with myself.

The prof considered me for a few seconds.

'That's about the measure of it. Not bad for a psychologist.'

It was my time to return the wry smile.

'And crucially, with one additional aspect,' he added.

'Which is?' I was sure I hadn't missed anything.

'Once we have a digital copy of a subject's entire genome it can then be transferred to the specialised software on that particular desktop.' He pointed in the direction of the computer just to underline his point. 'Thanks to some "blue-sky" programming which I don't even begin to pretend to understand. It has something to do with complex algorithms apparently or so the computer scientists working at the FSS told me. We should be able to use that genomic information to produce a base-line virtual facsimile of the subject under investigation,' the professor proclaimed.

'Any chance of that in plain English?'

'My work for the Home Office using criminals' DNA was further advanced than many government officials realised,' he said. 'Biologically speaking, I had discovered that it was possible to reproduce the data that had been created as a "digitally-existing", real-time computer-based clone.'

I had felt bowled over the first time the professor had sketched out his experiments just a couple of days ago. Now in all their detail and in the context of the procedure currently underway, they were even more mind-blowing. 'Is this what's happening with Edmond at the moment?' My mind raced.

'With Edmond's DNA, yes.'

The professor looked at me closely. I felt uncomfortable under scrutiny.

'What?'

‘With your specialised input we may even be able to produce a fully rounded, genuinely historical persona which truly exists in a contemporary environment. Albeit one restricted within the confines of a machine.’

‘I’m not guaranteeing anything,’ I replied. ‘A detailed profile takes time to get right.’ I was not sure that the professor was listening to what I had to say.

‘In about twenty minutes the sequencer will be finished its work and once the digital genome is downloaded to the software, we will witness the re-birth of Edmond Catchpole. Three-hundred and fifteen years after his original birth date,’ he said. ‘You will most certainly be the first person in history ever to be present at the birth of one of your great-great-grand-relatives. You may not be the last,’ he added.

‘Brrrr...’ A shiver rippled down my spine. The professor didn’t seem to notice my reaction. I walked back to where I had been sitting, picked up my fleece and put it back on. I felt the need to insulate both myself and my genes. I could do with a bit of thinking space.

‘Another coffee?’ I casually tried to disguise my unease.

He smiled and nodded. The professor turned back to monitor the final stages of the experiment.

The anticipation had become uncomfortable. I hurried into the teaching room and headed out to the main corridor. I was glad to get out of there. I sought the toilets and the kitchen in no particular order.

Refreshed, I ambled to the kitchen. It was hidden down a short, side corridor. Bit more upmarket than our one. I rooted through the cupboards. There’s probably a linear relationship between the quality of a faculty kitchen and the level of external funding, I mused.

I filled up a shiny new kettle and sorted out tea and coffee. My mind was full of questions about ethics and morality. I figured these would be wasted on Professor Charles. It seemed he had successfully managed to separate out his experimental endeavours from the complex questions posed by sociologists and philosophers. I had neither the luxury of time to adjust to his way of thinking nor resolve my issues. I didn’t possess the type of conscience to dissociate what I did in professional terms with what I felt to be right and proper.

I finished clanking around and loaded the drinks onto a plastic tray. This is going to be a struggle. I headed back to the office laboratory, the professor and the virtual re-birth of Edmond Catchpole.

I entered the office and could see Professor Charles crouched over the monitor. I set the tray down on the table between the settee and chair.

‘You’re back,’ he said without moving. ‘I thought you were going to miss the momentous occasion.’ He turned to face me. ‘Not getting cold feet are we?’

‘Just needed a bit of fresh air. It’s very dry. I’m not used to working in an air-conditioned environment,’ I replied. ‘Over in Psychology if we need to cool down, we just open a window.’

‘Okay,’ he muttered. The professor shifted his attention back to the monitor.

I picked up my tea and took a sip. ‘I’ll leave your coffee on the table professor. It’s probably safer over here,’ I offered.

‘You might wish to come and have a look at this.’

Wonder if he can sense my apprehension? I tried to put this out of my mind and crossed to where he stood.

I could see that the screen had changed from the previous folder display. It now showed a square portal that resembled an antique television screen. A flashing cursor ran from left to right in a continuing line, from the top to the bottom in a repeating process within the portal. As it travelled its methodical route the cursor deposited a fractionally small dot in designated areas of the screen. As this process progressed, a digital picture of a face was slowly constructed. It was eerie but compelling. Neither of us spoke. There was no need for words.

I finally broke the silence. ‘Is this how Edmond would have looked?’ Mesmerised by hundreds of the cycles, each revealing a pinpoint dot that built up into to the recognisable features of a young adolescent man, I was curious if this was a likeness or a composite approximation.

‘It’s a calculation based on his genetic make-up,’ the professor said. ‘The algorithms obviously cannot take into account any environmental factors such as diet or hairstyle or facial hair or accidents or illnesses or disease. So it’s an idealised portrait of what Edmond’s genes would have “programmed” him to look like. Fascinating isn’t it?’

I nodded. I could sense that there was relief in the prof’s voice as I had neither run screaming nor been stunned into total silence.

‘I’m guessing the visualisation element was honed at the FSS?’

‘Yes,’ he replied. ‘The approach was developed in conjunction with the unit’s software engineers. It offers roughly a ninety-five percent true likeness,’ he added. ‘This is probably what Edmond would have looked like.’

I was riveted. ‘Are the facial characteristics the only external features that the software can visualise?’

‘No. Not at all,’ he shook his head. ‘A whole-body image is eventually constructed. Once the facial characteristics are fully rendered, the software completes the rest of the external features. Then “he” or “she” is ready to be populated with relevant experiences and

information. These external influences somehow seem to interact with the genetic information. I know this seems a bit incredible but it does happen.'

The professor was on a rollercoaster and I was with him all the way. I listened and nodded. Too enthralled to interrupt.

'It is this interaction which seems to stimulate the creation of the subject's own personality. And in the case of Edmond, hopefully this will be a historically accurate personality,' the professor explained.

The sales pitch was a good one. Without seeing any verifiable or reproducible evidence that's all it was at the moment. He told a good tale. I had to give him that.

'You described this procedure as a "re-birth"?'

'Technically it is. This would be Edmond Catchpole's second coming. Forgive any unintended religious connotations. His second time around.'

'Then why doesn't the facsimile present as an infant?'

'Practical reasons.'

'Such as?'

'Producing a facsimile of an infant and waiting for it to grow would be fascinating but unworkable. Rightly or wrongly it would also cause too many ethical questions.'

'And creating that of an adolescent wouldn't?'

'Not so much,' the professor replied.

We continued to watch Edmond's construction. I was fascinated by the ongoing process of creation. Features were built up and modified. Edmond's face aged and contorted.

The professor cleared his throat. 'We are nearing the end of the manifestation of the subject's external features. By the time we are seeing this, the facsimile has already been internally constructed upwards from the base DNA at cellular level. In reality the digital clone is being created from the inside out. These external features are the last areas to be fully populated.'

The flashing cursor halted in its tracks. It began to fade from view. In the top right hand corner of the screen I noticed that alongside the single folder denomination, there appeared a time-code and today's date stamp: "26/12/2016". Edmond Catchpole's re-birthdate. The time-code was primed at 00:00:00:00:00:00. As the cursor faded fully the clock was set in motion. It counted every second from that point onwards.

'What exactly is the time-code counting?'

'Life-span,' the professor said.

I nodded automatically.

‘Oh my God! Did you see that?’ I shouted. To my astonishment the facsimile of Edmond Catchpole very briefly opened its eyes and closed them again, in a kind of inverse blink. ‘The Presence lives,’ I uttered.

‘The Presence lives...’ the professor repeated. ‘That’s a good description. I was looking for a suitable word to describe the facsimile. “Presence” will do nicely. Thank you for that. See, you’re already making a contribution.’

‘What just happened?’ I asked again. ‘The Presence, if that’s what it is, opened its eyes!’

The professor looked at me. He smiled.

‘The first numeral on the time-code signalled Edmond’s re-birth: the very second it came to life in this time period. It’s only natural, as with any new-born they try to respond to the stimuli around them. In this case, light.’

If my head had been spinning before, it was doing cartwheels now.

‘You mean the Presence…Edmond. He can see us? It or he or whatever it is?’ I was having problems thinking of Edmond’s facsimile as a “person”. ‘He has eyes?’ I exclaimed. It sounded like the dialogue in some ham-fisted sci-fi horror out of McCarthy’s paranoid middle-America.

‘Not in the biological sense of rods, cones, lenses, receptors. That sort of thing, no.’

‘But you said it could see us?’ I jumped in with both feet. Impatience getting the better of me. It was hard to tell whether he being was benevolent or not. At this point I don’t think I cared much.

‘That’s right. The Presence can see us. Part of the software development was to enable the facsimile to make full use of the audio and visual capabilities of the host computer. It’s an additional two-way feature that can be disabled if it becomes a problem,’ the professor replied.

Again I felt a shiver of apprehension as he finished his sentence. ‘The Presence can communicate with us, and us with him?’

‘Yes. Once it has the correct tools to do so. You need to think of the Presence as a new-born infant. Most of its responses will simply be motor ones until it is fed an input in the form of language, experience and stimulation. When it has these the required learning adjustment to whom Edmond Catchpole was or *is* again, should be at an accelerated pace.’

‘And you’ve already achieved this? Produced a fully functional and rounded facsimile with one of your Home Office-supplied volunteers?’

He seemed to avert his gaze for a split-second. ‘No. Not exactly. There was success in independent sections of the process but in terms of creating a rounded, contemporary persona from DNA, historical or otherwise, then no. This is about as far as the current research process has reached, on two previous attempts. It’s as if I have been missing a vital step. Something

which I can't quite comprehend yet,' he said. 'Never has the phrase "In its infancy" been more apt for a scientific project,' he added.

'Oh,' I managed and felt a mixture of relief and deflation.

'The software simulations and modelling all pointed to the experimental procedure being a success. In theory it should work but...' he tailed off.

The professor returned his attention to the creation. His creation.

It seemed as if there was a part of himself in there with Edmond. Through circuits and antique coding, the professor searched and hoped for lasting success. Like most obsessives, the need to discover had taken over the normal existence. Years of his life spent in trying to create an artificial one, at the expense of his own.

My attention turned from creator to creation. Edmond Catchpole had been alive now, if you could call it that, for a sum total of two minutes and five seconds. The features on Edmond's face twitched every so often. Apart from this involuntary motor reflex, all was calm.

Edmond's face suddenly lit up then became faint. It faded from view. It was if the power supply had surged then suddenly been pulled. The rest of the equipment continued on with a slight whisper, unfazed.

'No!' I turned to the professor. 'What's happened? Can't you do anything to save him?' I pleaded.

'I'm sorry.' It sounded as if this outcome was always to be expected. The professor shook his head and looked away.

The latent image of Edmond's outline dissolved. Within a couple of seconds there was no sign of the Presence ever having existed. The time-code in the top right hand corner had stopped. Against a blank screen it read: 00:00:00:00:02:09. The sum total of Edmond Catchpole's post re-birth life. It was as though someone had just died. Edmond's essence had.

I stared at the blank screen in front of me. After a minute or two, I began to doubt everything that I had witnessed. It all seemed so fantastic and so surreal. The only tangible evidence of the professor's rhetoric was a stalled time-code reading and that, on reflection wasn't much evidence of anything at all. I began to wonder if I had been the object of an elaborate hoax. For what ends though? And why for the benefit of just one person? I considered this in the context of everything that had happened with the professor since Christmas Eve.

During my temporary state of introspective lethargy, the professor must have walked away and sat down on the settee. He drank his coffee. Much like myself, disappointment seemed to be all too common to get upset by. The sudden failure of the experiment had not bothered me as such but the loss of its subject had.

I hated awkward situations. I always did the wrong thing. Although the professor looked calm I could never read people's emotions that well. I stood and walked over to the rest and relaxation area. I picked up my slightly shabby shoulder bag and waited for the prof to say something. He just stared in front of him and sipped.

'I need to make a move. My cat will be wondering if he's going to get fed today.' There was no reply or acknowledgement. I took this as a cue to leave the professor to his own thoughts.

'Right. Bye professor.' I walked towards the door.

'See you tomorrow then Judith. Thanks for your input today. I'm sorry I didn't have much more to show you.'

I turned around.

'I'll be here from nine or possibly a bit earlier,' he added.

His manner seemed strange to me but then again I didn't really know much about him. It was hard to make a concrete judgement. Professor Charles certainly wasn't the weirdest person I'd ever come across working in a laboratory. By any stretch.

'I'll see. It's still my holidays and there are a few things I should be getting on with. Family and friends to see. That sort of thing,' I lied. Who was I kidding? This was the most exciting Christmas I had experienced in a long time.

I left the professor in the office and headed out into the darkened corridors.

Be good to get back before the light fully goes. I tried my best to put the afternoon's events out of my head for a while. I needed a bit of distance before I brought those back into sharp focus.

I entered the emergency stairwell and remembered to disconnect the alarm before using the doors.

Once free of the building all I wanted to think about was getting home to Archie.

**

I didn't sleep so well on Boxing Day night. As a consequence I spent the following day cat-napping with Archie and was glad of the distraction that tiredness brought. This morning however I was wide awake at some unearthly hour. I had a sleep-hangover after overdosing the day before. I fed Archie early and went out on my bike to pick up a few supplies, mainly for his furry lordship.

*

I found myself at the gates of the University. A few more cars and vans were in evidence as the place returned to a brief normality in the interim before New Year's Eve. It didn't feel as eerie as it did the other day. Large campuses often do during the holidays. Feeling less circumspect about things generally, I decided to call in on the professor. Just for a couple of hours.

With any luck he will have gone to spend some time with his family. Wherever they are. 'I suppose I need to show a bit of willing,' I muttered.

I walked through the main doors into the reception area and placed my plastic ID in the card reader. With a metallic "clunk", an entrance turnstile lowered its barrier and let me through.

I strolled around the campus. I didn't see anyone else. There were signs of the usual maintenance work being carried out. Ladders, tools and ceiling panels removed. For emphasis an intermittent banging came from within the roof space. Its source somewhere off in one of the side corridors.

At least I don't have to be sneaking about today. I entered the Science Faculty and walked along the main corridor. This linked all the departments together. As I went by my own office I peered in the window. Everything was as it should be. I carried on through until the end of the corridor and climbed the two floors up to where the School of Molecular Biology was situated.

As I moved through the teaching lab and into the office, I saw that the professor was standing over the array of borrowed Forensic Science Service equipment. I let out a muffled half-hearted sigh. The prof had his back to me. I walked over to the break area and put my fleece, scarf and bag down. I noticed there were food wrappers strewn over the floor near the bin. And what looked like a sleeping bag half-tucked under the settee.

After my no-show yesterday, I guess I wasn't expected.

The professor seemed to be engrossed in what was in front of him. I looked a little closer. He was hunched over the PC display. Even from behind it was clear that this was not the same man I had seen only two days ago. He appeared dishevelled and unkempt. I prepared to use an unsubtle cough to make him aware of my presence.

'Damn. Damn. Damn,' the professor screamed.

I guessed he was unaware I was there.

He straightened up and kicked a lab stool over. A pile of papers that had been sitting on top plumed up into the air. They scattered across the floor. The stool crunched into the far wall of the office.

I sucked in a deep gasp. Louder than intended. This attracted the professor's attention. He turned around to face me, his eyes furious. For a split second I felt vulnerable. I instinctively shifted my weight, widened my stance and prepared myself. What I was expecting? I couldn't say but there was a look of anger across his face that stirred some dark memories. I had suffered unexpected violence before to know that anything was a possibility. Academic or

labourer, that look is the same. His reaction quickly dissipated. It was replaced by one of embarrassment.

'I'm sorry professor. I didn't mean to sneak in on you. I was just about to let you know that I was here…'

'No, no. Forgive me. It's been a long night and things haven't been going so well,' he said.

The prof sounded tired but measured.

'It looks as though it's been a long couple of nights,' I added. 'Bear in mind that you've been working here probably since Christmas Day and it's now the twenty-eighth. You've been at it for over eighty hours. That doesn't sound particularly healthy?'

He stared at me. I wondered what I had let myself in for.

'Not very productive either,' he replied.

The prof looked at the strewn papers on the floor and the prone, broken stool. With a wariness he started to tidy up the mess. After a couple of seconds I joined him.

As he moved from in front of the monitor I could see a log of dates and time-codes. Those must be tied in with more experiments on Edmond's sample. I scanned them as I picked up some of the papers. There were three more failed attempts on the day I had left. Eight more yesterday and another couple already today. I loitered longer than intended.

'Yes. They are all failed attempts. The longest, surviving no more than three minutes and twenty-six seconds.'

'I'm sorry professor.' My awkwardness reared up again. 'I wish there was something I could do? I'm only of any real use once there's a stable, living persona to work with. Until then I'm just a glorified gofer.'

'Far from it. You underestimate your own talents,' he said. 'What you in particular have to offer, no-one else can.'

I looked at him and shrugged my shoulders.

There was something in his voice and his manner that had changed over the last couple of days.

'I'm glad that you've come in,' the professor continued. 'Apart from rescuing me from my own pity, there was something I wanted to talk to you about. I wasn't sure whether I had scared you off or not?'

I half-smiled. 'No. Not yet anyway,' I replied. 'I know exactly what you're going to say. I should be getting on with preparing the psych profile and anthro data for Edmond,' confident that was what he wanted to hear. 'I appreciate you're working under a limited timescale. I'm sorry I haven't been more committed. I'll start this morning by preparing some data samples.'

I felt in a generous mood and didn't care that in all likelihood I had just signed the rest of my holiday away.

'That's re-assuring and will be most welcome. However there is something more pressing that I need your help with.'

I waited to hear the professor's request.

'It's a unique thing only you can provide. Before you get the wrong idea, it's not anything lewd,' he added.

My expression probably revealed that I didn't feel so magnanimous anymore. 'Okay.' I was ready to grab my stuff and make a swift exit, if and when the conversation started to head where I suspected it might. 'What's so important that only I can help with?'

'Take a seat,' the professor gestured to the break area.

'I'm fine standing.'

'Take a seat, please.'

I hesitated. 'If you insist.' I moved over to the single chair and sat down. He followed at a discrete distance and perched on the settee.

'As you are aware, the sample of Edmond's DNA which I acquired has travelled at least as far as Asia and back in its three-hundred or so years' history,' he said. 'There's no telling what sort of conditions the teeth have endured during that time but it can be assumed the specimens have not been kept in optimum conditions.'

I listened and nodded my understanding. So far, not what I was expecting.

The professor seemed calmer than earlier. 'The main hypothesis I can suggest for the fourteen failed attempts at creating a stable Presence, is that there may be an inherent fault with the source material.' He paused.

I waited for him to get to the point. I could take a wild guess where he would end up.

'With the contemporary subject material supplied by The Home Office I was able to perfect the procedure and achieve reliable and reproducible results,' the professor added.

Why doesn't he just tell me what he wants? I settled back into the chair.

'Clearly there have been external factors which have in some way disrupted the reliability of this historic sample's genetic code. Sections of Edmond Catchpole's genetic make-up are missing. This has resulted in an incomplete genome map of the subject and is most likely the root cause for the failure of achieving a stable Presence.'

There it is. He expects me to be some sort of donor.

'You've taken material from across the sample?' I asked.

The professor looked at me stony-faced.

‘Most of the fourteen attempts have used fresh samples taken from a range of locations across the source,’ he said. ‘So yes, I am confident that the material itself is the problem and not just an aberration in one or two sections,’ he stated. ‘I appreciate the double-checking all the same.’

I nodded. This short exchange fell off into an awkward silence.

The professor’s demeanour shifted. He appeared uncomfortable and unsure of himself.

‘There’s no easy way to ask this. So I’ll come to the point as succinctly as I can.’

‘Okay.’ I felt relaxed. I believed I had the upper-hand.

‘There is a proven theory which suggests, much like an organ or bone marrow donor a person with a related genome can successfully “donate” a piece of their genetic code to a relative. You’ve heard of so-called “designer babies”?’

‘Yes, of course.’

‘In Edmond’s case, there are probably sections of his genome needed for genetic coding which have lost any ability to self-repair and in effect become “junk” or “non-coding” DNA,’ he explained. ‘Theoretically, these “non-coding” DNA sequences or “pseudogenes”, could be re-activated into protein-coding sections with a fresh infusion of near-identical DNA. This would act as a switch to turn the coding ability back on,’ he added. ‘A great deal of this is hypothetical but I’ve tried everything else.’

I listened and waited for him to get to the point.

The professor’s composure returned. He straightened up. ‘What I am asking from you and it can only be you as you’re the only female Catchpole in the immediate locale, is the donation of a sample of your DNA to try and repair the likely damage in Edmond’s own material,’ he said without any hint of emotion.

I knew it was coming but I still felt numb. I suspected this is what he wanted all along. It wasn’t until I heard him ask that it became real. Despite my initial plans to bolt, I didn’t move. My mood of enforced calm evaporated. Ideas, actions and replies raced around my head but none formed readily into a coherent response.

A few seconds felt like days. ‘You planned this all along?’ I squeezed out an opening salvo.

‘Not all of it Judith…’

I felt a cold shiver as he used my name.

‘You have to believe that,’ he added. ‘I had no idea that Eustace had a researcher named Catchpole. Honest. Let alone that I would be able to work with you on this project.’

‘Why don’t I believe your claims?’ I tried to regain some of my earlier focus. I had no idea what this man was capable of. Was he unbalanced or just incredibly driven?

I could see him reign himself in. It was clear he didn't want an argument. The professor composed himself. This made me nervous.

'The history of scientific discovery is peppered with unlikely coincidences. You have to believe me that this is just another one of those.'

'It's also littered with extreme manipulators and their machinations,' I countered.

'I wouldn't consider myself in that category. I'm not out to harm anyone. My intentions have always been focussed on moving the sum of knowledge forward.'

I wished I could be certain of that. Keep on talking Judy, keep on talking. At least that's one thing I'm good at.

'There's no doubt that your experimental work could provide incredible insights but the way you have approached it has turned the research into an ethical minefield,' I replied.

'My only concern is with empirical matters. The philosophy can be debated by others.' The tinge of arrogance seemed out of place.

'If all this was just a coincidence. And say for argument's sake I believe you. How did you ensure that I'd be working on the project at exactly the right time?'

The professor smiled. 'That was one area which was not left to chance.'

'What do you mean?'

'Professor Eustace and his sabbatical research trip.'

I felt my stomach turn over. 'What have you done with *my* professor? I knew something was up when I hadn't heard from him since the end of term.'

'Done with him?' Professor Charles sounded surprised. 'I have not "done" anything with him. Quite the opposite, Ms Catchpole.'

I considered this for a couple of seconds. I started to connect a few of the loose threads which had been troubling me since Eustace's departure.

'You arranged his research trip.'

'Yes. Well done. I arranged it all,' he laughed as he admitted his scheming. 'Made Eustace an offer he couldn't refuse. All taken care of through the University Research Group. I was able to set some money aside from the FSS grant and send him off on an extended sabbatical. An academic opportunity of a lifetime. To undertake an anthropological field study of his own choosing, on the other side of the world.' The professor laughed again. 'The only condition was that you were seconded to my area. To assist with an on-going research project.'

I stared at him in disbelief.

'I'm sorry for the underhand way I dealt with things but time was always going to be against us,' he added. 'Sometimes you have to put feelings and emotions aside and just get on with what you sense is right.'

I felt used. Grubby. But also relieved. I knew Eustace would have taken me with him if he could have. I felt some consolation at not being so willingly abandoned.

'So why me?' I confronted the professor. 'Surely you could have obtained a blood or tissue sample under some pretence, from any number of suitable Catchpoles across the country?'

'It only occurred to me during this latest experimental impasse. I needed to consider a new, radical way forward. It may not even work but I am desperate and running short on time. I'm not normally this obsessive. I have to obtain some viable results or all those years of work will have been for nothing.'

My head started to spin. 'You're expecting me to believe that in all your plotting and scheming, you never intended to try to physically use my heritage to further your research?' I drew in a sharp breath and tried to clear my thoughts. 'I find that very hard to accept. Even if I wanted to,' I added.

'You are of course free to believe what you wish,' he said. 'All I originally wanted from you was to make the most of your connection with a distant ancestor, Edmond Catchpole. I was hoping that through your work in constructing a framework for the Presence, you may have been able to provide an unconscious, extra empathic angle.'

Sounds plausible, I thought. It makes some sort of sense. But can I trust him? I was unable to dissociate fact from half-truth.

'What I am guilty of is obtaining your scientific services and expertise through underhand methods but that's all,' he added. 'However I am now out of options, so I have no choice but to ask you for a sample of your DNA: your shared heritage.'

I felt I was on a rollercoaster ride. I wanted to believe the professor. He seemed genuine. His explanations plausible. He admitted his mistakes and manipulative behaviour. Was this enough to persuade me? I didn't know.

'At this precise moment I don't care what you want,' I said. 'I don't like being used. Not even if the end result could justify the means. Which in this case it may well do. I just can't trust you professor.'

I stood up and started to collect my things.

'Please Judith.'

That shiver again.

'Can we talk about this rationally? We are scientists after all,' he added.

As he spoke I put my fleece on and shouldered my bag securely, leaving both arms free. For what I wasn't sure. I had already seen a display of his temper. I didn't want that fury directed at me.

The professor rose up. He partially blocked my route. I sidestepped him as deftly as I could.

‘Judith, please?’

I preferred him calling me Ms Catchpole. Or even Judy. I don’t know what it is but his use of my full Christian name just felt wrong. It was creepy.

‘Consider what this could mean for the collaboration between Psychology, Genetics and Anthropology? It could be ground-breaking,’ he said. ‘You could have your name immortalised in the scientific community. Forever.’

‘No thanks. I think I’ll stick to my own field and leave you to worry about biology and genetics. As for the fame or rather infamy, I’ll pass on that. But thanks all the same.’ I moved towards the office door. The panic remained locked down inside of me.

With a lighting turn of speed, which I neither saw coming nor expected, the professor managed to place his body between myself and the only exit.

‘Believe me Ms Catchpole, I don’t like this situation any better than you do. I have tried to appeal both to your scientific and personal nature but you seem incapable of listening to reason.’

He took out a sturdy hollow glass tube from his jacket pocket. At one end was a piece of cork skewered onto the tip. The professor removed this to reveal an angle-sliced, pointed edge. It reminded me of a piece of cut bamboo.

I would have to get past him. And quick. I rushed towards where the professor stood. I put my arms up to protect my lowered head. I was three foot away from the doorframe. I saw him raise the glass tube. I kept going, unable to stop even if I wanted to. We made contact. Carrying most of the momentum and being of a lower centre of gravity, I bundled straight through into the teaching laboratory. Behind I heard the professor smash into the doorframe. I heard a crack and heard him cry out. I felt a sharp pain in one of my hands. As I left the lab, I glanced back. Professor Charles was slumped awkwardly in the office doorway. He groaned. My adrenalin-fuelled heart was racing. I tried to get it under control.

At least he was conscious. I was afraid that I had charged him with too much force. Old rugby habits die hard, I thought. He must have stepped out of my direct path. I was relieved more than angry. He might need some medical attention though, if that crack I heard was a bone. That’s his problem not mine. ‘I’d call that a draw,’ I said to myself. ‘Neither of us would look good if this got out.’ I didn’t suspect he was going to the police or university authorities anytime soon.

As I tried to deal with events through bravado and bluster I caught an image in my mind that I couldn’t quite process. I filed it away.

Once down the stairs, I made my way through the Science Faculty and into the main reception. As before there were no physical signs of anyone around but I could hear them all

the same. I looked down at my hand. It hurt. There was blood dripping onto the carpeted floor. I looked behind me to a thin trail of blood linking my location to the stairs. I must have torn the skin on the doorway, I thought. It will need cleaning up. I'm sure Canterbury Cathedral's bye-laws forbade the riding of a bicycle with a bloodied appendage. I tried to keep my spirits up. My whole body was shaking.

Opposite the main reception desk there was a collection of washrooms. I pushed open a large door to the disabled bathroom. It was the only washroom which could be securely locked from the inside. It also had an emergency alarm. Just in case.

An overhead light automatically sparked into life. I locked the door. My reflection was rough but ruddy although I felt like a hunted doe. I took a few deep breaths to try and calm myself. These rattled my throat as I exhaled.

I turned on the hot water and stuck my hands under the tap to wash the blood away. A sudden, sharp debilitating pain exploded simultaneously in my head and right hand. My stomach lurched. I felt sick. I kept my mouth shut tight and stifled both cries and bile. For a split-second I couldn't figure it out. Under the stream of water I flexed my fingers. I hadn't broken anything although the pain was excruciating. I inspected my hand. I sensed the ruddy colour drain from my face. On the edge of my palm just below the little finger, there was a distinct puncture wound. The circumference of a pencil. It bled profusely.

A synaptic contact closed. I resolved the image which escaped me earlier. *Slumped in the doorway the professor was holding a bloodied glass tube.*

So, Professor Charles had his sample after all, I reflected. His piece of me. My victory seemed hollow. I played directly into his hands. It was the only realistic way he could get close enough to extract a sample of soft tissue.

'What a fool Judy,' I said loudly. I didn't care who heard.

I would need to retrieve that tissue sample. But that was a job for later. My hand required urgent attention. The wound seemed about an inch or so deep. It looked nasty but clean. It will definitely need stitches. I steadied myself as a wave of nausea swelled up and washed over me.

I decided to leave my bicycle near the campus. I wasn't in a fit state to ride. I wheeled it to outside of my local, *The New Inn* and chained it up. Kurt, the landlord there for as long as anyone could remember, knew me and my bike. If it was there for a day or so, he wouldn't think anything of it.

*

I arrived at the Kent at Canterbury hospital. My hand was padded out with toilet paper, wrapped in my scarf and enclosed in a plastic carrier bag. I was pleased with my triage attempt. At least it probably kept the wound sterile.

I managed to find the Minor Accident and Injury Unit, after being misdirected by new signage which didn't seem to link up properly.

After filling in countless forms, fielding one or two awkward questions and then waiting in a holding area, I saw a nurse. She had a quick look at my wound and superficially dressed it. She handed over a blister pack of strong painkillers and gave me a tetanus injection. All of this with a genuine smile.

It was another three hours or so before I had my hand stitched and bandaged. Everyone waiting to be seen was in the same boat. Minor injuries and broken bones. No-one complained. I think we just felt grateful that we were in a safe place and would eventually be fixed up and sent on our way.

After treatment I signed a few more forms and was discharged. I visited the bathroom to clean my scarf and check I didn't appear too dishevelled. Cleaned up, I walked back along the faintly lit corridor towards the reception and exit.

Professor Charles strode in from the darkness outside. My earlier feeling of safety evaporated. I had lost track of the day. The winter evening was already evident. He crossed by the top end of the corridor. I was far enough down and in the shadows to be invisible. All the same I held my breath and stood stock still for a few seconds. He looked comical. A large wad of cotton wool and more than a few plasters held his nose in place. I had heard a crack earlier but I didn't realise it was his nose. Oh dear, I thought, that will take some explaining. I wondered if others knew how malevolent and dangerous this clown was.

Once the initial paralysis and shock subsided, I let out a desperate breath and inched along the corridor. I kept in the shadows as much as I could. I reached the top and carefully peered around the corner down to the main reception space. I knew the layout. I had little else to look at for the last five hours and focussed on where the professor was likely to be. I spotted him about a hundred feet away in the queue for the reception desk. There were a couple of fellow walking wounded ahead of him.

I can't risk just strolling out. What if he spots me? 'Wait until he's busy sorting out the paperwork,' I muttered. 'That will keep him busy for a few minutes.'

As I bided my time I made an attempt to affect some level of disguise. I wore my fleece inside out and tied my hair up in the damp scarf.

My opportunity came five minutes later. Three hundred seconds of furtive glances and attracting suspicious looks. I think the only reason security weren't called was because my bandaged hand made it obvious I was a patient there.

Once the professor's back was turned I waited to make my move. His patience with the bureaucracy and paperwork had evidently worn thin. His protests provided just the level of distraction I was waiting for. 'It's now or never,' I whispered and slipped around the corner of the corridor. I walked right by the reception desk and out into the night.

Despite my wounded hand I needed to act quickly to recover my bio-genetic property. I had been patient enough to wait for five hours. Professor Charles would not wait five hours for anyone. I swallowed a couple more painkillers and set off for the University campus.

*

I approached the ground floor of Molecular Biology under cover of darkness and stopped outside the emergency exit doors. I slipped my fingers through the gap at the top and disconnected the alarm wires. I presumed this is how the professor managed to get in unnoticed. I tugged as hard on the left hand door as my weaker arm would allow. Eventually it prised open. I stepped inside and re-connected everything.

With only emergency lighting for illumination, I carefully made my way up to the first-floor corridor and on to the professor's lab. I was certain he would not be back yet. The over-worked and under-staffed Minor Accident and Injury Unit would see to that. Despite his absence I could still be caught by campus security and left at the mercy of the justice system once again. It was an irrational fear because this is where I worked. All the same it still made me uneasy.

I reached the teaching laboratory. The outer door was unlocked. Once inside I bolted it behind me. A couple of the overhead strip lights had been left on in the lab and rear office.

'Bugger it!' I shouted in frustration. The door to the rear office and the Edmond experiment was locked. I shook the handle violently. I realised the top half was plate glass. It looked thin. It's only a window. They break all the time. A gentle tap and it's gone.

I searched for something to help smash my way in. An oversized pestle obliged. I poked the glass in from the top down and used my bandage as makeshift eye-protection. I climbed through the empty frame. With one leg in I noticed the lock had a catch on it. Dummy, I thought. I reached over and turned this clockwise. The door opened with my leg still in it.

Out of the frame, I pushed the door open and swept away the large pieces of broken glass. My boots crunched the smaller fragments as I walked across the office. The professor had left the equipment switched-on and ready to go. On the settee splatters of dark dried blood were everywhere. Bundles of green bloodied paper roll lay discarded on the table top.

He had it coming. Don't you dare feel sorry for him! I shook his image from my thoughts. There was only one thing I was here for. And that belonged to me.

I assumed the professor had stored my blood and tissue sample in the chiller cabinet alongside Edmond's. I walked by the monitor and caught a brief reflection of someone behind me. I held onto my breath and spun around to face them. There was no-one there.

'Phrrr…' I exhaled. Just nerves playing tricks.

I opened up the cabinet and searched through the samples. I found what I was looking for. Tucked away in the corner were two vials bound together. One labelled "Judith Catchpole / Epidermal Tissue / 28/12/16". The other contained a sample of my blood. I examined them in the fluorescent gloom of the office. In one glass tube a piece of me bobbed around in a yellow, viscous fluid. In the other, deep velvet liquid clung stubbornly to the sides. I felt sick. My hand ached for its missing flesh. I placed the vials in a padded section of my bag and rummaged around for the painkillers. I swallowed two with a dry "gulp", and put the rest in my jacket pocket.

Time to leave. I considered whether I should put the professor's experimental set-up out of action. 'No,' I said. 'In here, I haven't really done much wrong. The door was an accident. I was locked out.'

As I crossed the room I caught a glimpse of peripheral movement again. I faced towards the door this time, so was certain no-one else here. Curiosity drew me back to the monitor screen. Three recent additions focussed my attention. A new folder, the fifteenth, had appeared on the screen since this afternoon. It read "PC/EC/JC/281216". The second addition was a date-stamp: "28/12/16". And the third was a related time-code, live and running at 00:00:00:02:45:23.

I stared hard at the figures and letters. I struggled to make sense of them. Then they fell into place.

'Somehow, even with his injuries he managed to extract a sample of my cellular DNA.' I gazed at the screen. Scenarios raced around my head. From my fist, to a vial, to the PCR and into the microarray. The simplicity of it shocked me. A sample of my uniqueness prepared and ready for that maniac's facsimile generator. Or worse?

I moved closer to double-check.

'Arghhh!' I let out a scream that I tried to muffle as soon as it started. An image. A three-dimensional face reared up on the screen out of nowhere. Eyes fully open, mouth gaping, nostrils slightly flared. As *he*—it was definitely masculine—moved forward, I reeled back. This was no reflection. This was a real Presence. Generated from inside the professor's machine.

Shocked but fascinated, I returned to the screen. The Presence opened and closed his mouth in irregular motions. It wasn't an automatic response, he was trying to say something.

"Orrr..." was all that came out. Other guttural sounds followed.

'The professor's theories were right,' I said to Edmond Catchpole's latest Presence. I was unaware whether he was capable of understanding or even hearing me. 'I suppose we both share more than just a family name now, dear Edmond,' I added. I felt waves of anger and sorrow break over me.

I reasoned that he was as "alive" to me, as I was to him. I stared into his features. Edmond's Presence became still and returned my gaze, punctuated only by the occasional blink. Perhaps it was a genetically shared empathetic feeling that settled over both of us. I experienced a rare moment of quiet. A calming solace in the maelstrom of emotions that had rapidly become the norm for me.

My initial thoughts had been to destroy this latest folder. That was before this extraordinary shared-experience. If I had not gazed upon Edmond's face, I would have deleted it.

I felt this entity was as much a part of me as it was of Edmond Catchpole. It was clearly an even choice between nihilism and narcissism on my part. Too much philosophising was a bad thing. Probably the only point on which I agreed with the professor.

I turned my eyes away from Edmond's Presence. What should I do? I can't leave this or any future enhanced Edmond at the mercy of the professor. I needed as clear a head as I could manage. Professor Charles would return tonight. I knew that for sure.

I paced around the office as I searched for a focal point and as much clarity as the pain killers would allow. "Hope out of desperation" was an ethos by how I lived my life and today was no exception. I concentrated on just the next couple of days. The short-term focus helped forge an idea. It wasn't fool-proof but it was all I had.

I searched through the extra boxes we had picked up on Christmas Eve. I was sure that what I was looking for would be in there. After sorting through cables and pieces of electronic equipment, I managed to locate a portable hard drive. Together with the professor's laptop and a couple of data transfer cables, I set to work.

I re-formatted both the portable drive and the secondary data drive on the laptop. I connected these to the FSS desktop and transferred all the files, folders and software. One full copy onto each drive. I checked the data transfers were successful and Edmond's Presence in folder fifteen was still "alive" in his new home on the professor's laptop. The time-code ticked over.

I had two full working copies of the professor's work. A main copy and a back-up was all there needed to be. I hesitated. What I planned to do was the worst of all academic crimes. But it was the only way to be certain. Professor Charles could not be allowed to replicate his last experiment using my DNA in combination with Edmond's.

'No regrets,' I said to myself.

I re-formatted the multiple disk drives on the FSS desktop. This erased every last trace of the professor's current experimentation on those drives.

Once this was completed I shut down all of the equipment. I packed the portable drive and laptop into my bag. I tried to be as methodical as I could but time was against me. I did not wish to be here when the professor returned.

I was careful not to destroy anything physical. Apart from the professor's laptop, portable drive and my samples, I had not taken anything else. When I was in a position to transfer the files from his laptop onto my own, I would make sure he got back all his work. Minus any current experimental data of course.

**

A tour of the England's Lake District had always been top of my to-do list. Maybe not during the winter months. It has been quiet though and cold rather than wet. Beautiful all the same. Walking on the shores of Coniston Water, enveloped in an icy mist.

I thought it would be prudent to disappear for a short while until the new term started. Two weeks wandering through the magical Cumbrian heartland was just what I needed.

I was careful to try and minimise any professional damage to either myself or Professor Charles. Although I did have to consider my own safety and job security. Before my temporary hiatus I sent out two emails. One to a spread of addresses at the Forensic Science Service. One to the Head of Sciences at the University. I wrote telling them that the FSS research equipment could be found in the professor's teaching lab. I added that as an employee of the University, I had been obligated to raise concerns as to whether this classified and politically sensitive equipment had been correctly cleared to be used off-site and on University premises.

As for Edmond's Presence. He's still alive and clocking up those seconds. More and more each day.

END

(End of Creative Element)

RATIONALE

Introducing the Rationale

The rationale consists of discrete chapters that consider the methodology employed both in the creation and writing of my practice collection, and in the contextual aims and motivations for choosing the specific approach and frame of the investigation. The detail of this exploration across both critical and creative endeavours will offer the opportunity for an analytical insight into the workings (and merits or otherwise) of this practice-based study.

Chapter ONE reflects on the formal creative decisions taken in respect of how my individual practice pieces relate to discussions of accepted form and genre in contemporary fiction, science fiction and speculative fiction. I consider how my pieces have been built around characters on the fringes of professional science, and not around the more rigid conventions that might be expected when writing in the combined areas of fiction and science.

Chapter TWO assesses the writing of science-as-fiction in the context of a literary scientific environment. Authors and their fictional characters are explored, alongside the notion of a scientific-literate readership, framed against a socio-philosophical backdrop which all feeds into an appetite for science and technology in contemporary fiction.

Chapter THREE looks at the academic concept of practice-as-research (PaR) and considers my practice-based approach as a research study within a suitable context. The applied discussion on creative writing as PaR is intended to follow both the *Creative Writing Research Benchmark Statement* (NAWE, 2018) and the categorisation used by Robin Nelson in his concepts of 'Know-how', 'Know-what' and 'Know-that' to help illustrate possible routes and interactions for both designing and understanding the notion of 'Practice-as-Research'.

Chapter FOUR examines the approaches taken to creating my practice-based research (in a collection of creative work). I discuss the development of characters, initial ideas, storylines and the creative enterprise of weaving science fact and speculation, into plausible and entertaining fiction.

Chapter FIVE considers the development of a critical-creative approach to research through evaluating a relevant collection of published fiction and then undertaking a comparative analysis between one piece from this collection and a self-originated piece. This applied approach to practice research—and its influence and value—is considered against the design and writing of my own creative practice.

Chapter SIX considers how a range of material from science and genetic science informs my creative writing practice through applied science-subject research and on into the development of suitable characters and storylines, in tandem with solid science and credible speculation.

A **Conclusion** presents my thoughts on the two main components in this study—the creative and the rationale—and how these developed my understanding of how science and fiction can be combined to produce a structured and engaging experience.

CHAPTER ONE
Writing and researching form and genre in the practice-as-research (PaR) collection

The prime focus of my research study is to create science-inspired fiction that delivers a selection of contemporary issues in (genetic) science. These works of speculative fiction[3] offer an insight into a range of the processes involved in (genetic) science, through a collection of engaging characters within accessible formats. This enables me to interrogate (genetic) science through a body of original creative practice, as wholly integrated, complete pieces of fiction. My motivation for this approach is two-fold: from a creative perspective, it is designed to bring an appreciation of the issues and processes of (genetic) science into works of fiction, and from an academic perspective, it offers a selection of work that illustrates this approach without resorting to either overt didacticism or over-simplification, and further, offers the opportunity to interrogate original works of science-as-fiction from inception to completion.

The fundamental aim of my research is to investigate and question—through creative practice—whether (and how) the form of fiction can be employed to represent the empirical nature of science, scientists and the processes of undertaking science (including genetic science), through contemporary factual-based fictional characters and stories. As an integral part of this, the study seeks to offer through applied practice an insight into potential methods and approaches for using factual scientific material as the driver and content for creative practice.

Within my PaR investigation, the production of the creative writing exists within a critical context of science in society. This considers how contemporary writers utilise science—sometimes as a plot device, sometimes in the guise of a character, sometimes as a backdrop to the main story—to provide heightened dramatic tension which the inclusion of a science element can often bring to a piece. This integration of recognisable science within fiction (whether contemporary or near-future speculation) can often bring with it both an appreciation but also a mistrust of science and technology. This duality can be illustrated through John Steinbeck's biologist character 'Doc' (based on Steinbeck's friend and marine biologist, Ed Ricketts) in both the *Cannery Row* (1945) and *Sweet Thursday* (1954) novels, and

[3] I consider that speculative fiction is based on a contemporary or near-future scenario in a recognisable world/society, dealing in concrete scientific ideas, science processes and associated technologies.

Kazuo Ishiguro's notion of human farms (illustrated through the experiences of the central characters of Kathy H., Ruth and Tommy) in *Never Let Me Go* (2005). In these examples the undertaking of science (and its consequences) has benefits and drawbacks, depending on who the character is. In my own piece, 'The Patient Experiment', this duality is illustrated through Dr. Balfe's actions. He feels mistrust towards the research facility where he is employed but realises that he is also in a unique position to bring compassion and comfort towards his patient, TP.

The critically facing element will look to address issues—in this and subsequent chapters—such as the accuracy of an author's approach to science (including associated technologies), the ways in which contemporary writers have used science in fictional narratives, and how the elements of science, technology and fiction can be viewed in the context of a late twentieth century (and early twenty-first century) philosophical and socio-political perspective. In addition, the critical work will also investigate whether concerns about the validity of the scientific content and context are necessary, as my pieces and the science-as-fiction published works I cite in this study are ultimately works of fiction (albeit set in recognisable and familiar landscapes).

Situating the dual critical and creative approach

There are two major elements to this research project. Firstly, there is the creation and critique of a body of original practice-based creative writing in the form of a themed or linked collection, consisting of three speculative fiction pieces. And secondly, there is the critically facing element that includes an evaluation of practice-based research as an analytical tool, developing a critical-creative approach to practice, conclusions drawn from a comparative study, a critical appraisal of the creative development within the collection and a consideration of my practice in a wider context of genre and non-genre writing.

The creative work is presented as two novelettes ('The Commuter Lab' and 'The Patient Experiment'), and one novella ('A Common Thread'). Author and critical writer, Lisa Tuttle in her book, *Writing Fantasy and Science Fiction* (2005), offers a useful quantitative baseline guide for a range of fiction forms. I have used this as a benchmark for the purposes of this study. Tuttle's market-led quantitative classifications are as follows: '…the short story is defined as a work of fiction under 7,500 words; the novelette from 7,500 to 17,500 words; and the novella from 17,500 to 40,000 words. Anything over 40,000 words is therefore a novel' (p.115). The writing presented in my collection takes the form of narrative prose in a

fictional format. I will refer to this simply as 'fiction'. When discussing the individual creative pieces, I will refer to them as a 'novelette' or a 'novella' or a 'fiction' or a 'piece', or jointly as my 'pieces' or 'fiction/s' or 'work/s' or 'collection'. I occasionally use the term 'narrative' with the intention that its use will refer to aspects of structure.

The use of the novella and novelette forms has been dictated to somewhat by the types of fiction that I wished to write. The structural outline of each piece in the collection follows a main central character who is tied to its major theme of genetic science—in a variety of narrative situations—and who directly affects or is affected by this theme. With each fiction there is one key plotline around which all the characters revolve. Unlike in a (standard) novel where there are often multiple plotlines (subplots) which engage a number of main and supporting characters that come together in the resolution, I use a single-strand plotline in an effort to deliver a narrative simplicity, in order to engage the reader in a dramatic impact whilst tackling complex areas and subjects. The stripped-down form of both the novelette and novella allow this. Their physical lengths can accommodate an amount of character development along with the build-up of ideas, layering of story strands and story issues that a traditional short story could not. Nor would the short story form be an appropriate mode to deliver the complexity of subjects and situations that I look to develop with my fiction. With the term 'novelette' there seems to be an element of debate whether the form is distinct enough to merit a separate classification. According to Kristina Adams (2017), what distinguishes a novelette—possible focus on one main character, layering of story strands, spanning a longer period of time, following a chain of events and, with some depth and exploration—can also be equally applied to the form of the 'long fiction' as Gardner (1991, p.183) refers to it. In terms of the novella this is further distinguished from the novelette as it more '…often focuses on character development or a character's journey' (Adams, 2017). As my writing projects initially moved out of the bounds of the short story during the development stages of my collection—and the complexity of each of the pieces became apparent—I did use the interchangeable term 'long story' or 'long short story' but only as a descriptive label. I now use the terms novelette and novella as more accurate terms for my creative work.

As a key component of this critical element I present an overview of an analytical study undertaken on Andrea Barrett's *Ship Fever* collection (1996). It is the work on this analysis that led me directly to the development of my critical-creative approach. The development of this was out of necessity, as I searched for a suitable way of analysing science-as-fiction texts to gain an insight into how they were written, constructed and whether there were any

commonalities. I decided that I would need to create a tailored approach and so devised a set of criteria with which to examine various aspects of the writing, structure, character construction and integration the science involved. I introduced my findings into the preparation work for my own creative practice, so in this way part of the reason for engaging with an analytical approach has been to investigate the constituent parts of a collection of science-as-fiction, to instruct and inform my own practice.

After I had begun to complete some of the early pieces in my collection, I decided to return to the analytical approach with a view to applying a revised set of criteria to one of my own and one of Barrett's pieces. This became the basis for the comparative study between a piece from my own practice ('The Patient Experiment') and one from Barrett's collection ('Birds With No Feet'). This comparative study is very much linked to the groundwork for this thesis presentation. It is subject-specific and probably has limited relevance outside of this approach. However, the reason for undertaking the comparison was to provide a measure so I was able to develop my practice along similar lines to achieve similar outcomes (even though my collection is very different from Barrett's, they share common factors, as illustrated in the comparative analysis). The outline of my original analysis along with the approach and findings from my comparative study are detailed in Chapter Five.

Cultivating a critical-creative approach across my research study has proved to be a very crucial addition to the methodology. It has enabled an appreciation of how creative work can interact with a critical understanding to provide a wider scope for realizing how some parts of the content in the practice affects aspects of the critical. An example would be how the depiction and exposition of complex laboratory processes in 'The Commuter Lab' may affect the reception of that information i.e. how the level of technical language could influence engagement with the narrative.

This leads into my main line of academic enquiry for this study: Through the production of creative PaR, how do my creative pieces explore implications and effects of (genetic) science in society, as they attempt to (re)present them as fictionalised but recognisable, contemporary speculative scenarios? This approach to my research allows me to investigate (genetic) science through producing a body of original fiction using a range of methods including a critical-creative one.

In addition, there is an important critical aspect that is addressed through the practice-based research: Whether any of these contextual issues about how science is used in narrative fiction are even an important or useful consideration, as they are after all, works of fiction. But as I write this, the fictional scenario in 'The Commuter Lab' that speculates on the

covert collection of personal information through a mobile (gaming) app in a relatively transparent but underhanded way, reflects the current Facebook and Cambridge Analytica debacle presently unfolding[4] and as such, we can see how fiction can be premonitory as science and fiction travel down the same route, albeit on different tracks.

Speculating in fiction and science as a stimulus for content and genre

Whilst I use science content as a number of *themes* in genetic science, my aim is not necessarily to create fictions about science or scientists; the main driver and concern for my creative practice is the development of scientific and fringe-scientific characters who are able to carry and deliver the storylines and the ideas in those fictions to as wide an audience as possible (and not just one interested in science or genetics). So, the ideas of science in this way are used to infuse characters and storylines with content through which the characters will entertain, explore and communicate. While the main protagonists within my creative practice may be scientists and science-related characters, this is not an exclusive requirement, as I have discovered that the main character(s) for each fiction is (are) best positioned when they are on the periphery of a recognised scientific hierarchy.

The style of this character-based approach is one that initially is representative of science issues, which then develops into a human story and consequently becomes one filled with emotion, life experiences and relationships – instead of one (directly) about science. From a comparative/contextual perspective, this seems to be the strength of Barrett's *Ship Fever* collection: they are ostensibly about relationships whose characters are proto-scientists (naturalist-collectors) who represent issues in science but are allowed to be 'people' in the fiction, rather than playing a supporting role to that of 'science'.

The fiction in my collection, as I have stated, is—I consider—speculative. If this is taken at face value, then I am using the form to speculate about how the near-future of genetic science (and science) will impact on our society in ways that are rooted in present fact, empirically based science and current scientific theory, and the method I am using for this is through the writing of a contemporary collection of science-inspired fiction, in the form of two novelettes and one novella. The material I have written is not science fiction; it is based on research-led science fact. I am not looking to create a future that is fantasy or imagined, but one that is like the present we live in. The science and technology I have used in the fictions is not fantasy, theoretical supposition or blue-sky imaginings. The majority of it is

[4] For a detailed consideration of this news story and its chronology see *The Guardian* article, 'Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach' by Cadwalladr and Graham-Harrison (2018).

currently being used or designed in laboratories today. It is concrete and viable not imagined or currently improbable. Each of the three pieces in my collection is based on current genetic science techniques or theories, and therefore I argue that what I am presenting is speculative fiction. In my first novelette, 'The Commuter Lab', both the procedures for gathering material and data analysis are consistent, if a bit unorthodox—but then I am writing fiction—with what is found in a standard genetic science laboratory. The speculation (and so, fiction) comes through the identity of the material that is being collected. Where has this come from and, ultimately, what will it (and the results) be used for? The second novelette, 'The Patient Experiment', makes use of the groundwork already established in terms of genetic material analysis and is able to focus on extrapolating an unusual medical condition that slows down the process of *Oncosis*—cellular reactions that lead to cell death—to a genetic condition that stalls this activity long enough for the individual cells to 'repair' themselves and re-establish homeostasis. The final work, the novella, 'A Common Thread', is again able to build on the previous pieces, as it combines elements of science, medicine and genetics to speculate on recreating a digitally enhanced representation of a once-living person's genetic material, in combination with that of a (future) present descendant, to help complete any broken or missing sequences. 'A Common Thread', is perhaps the most speculative of the collection but even this technology is currently being employed in the development of 'three-parent' babies, through genetic donor/substitution therapy. It is through this research-based approach that I offer my collection as one consisting of a variety of speculative fiction.

Ultimately, the aim has been to keep my ideas grounded, so the pieces are not too far-fetched, but within a few years' grasp. As my creative work contains speculative elements, it is useful to help establish a recognised position on the differences between science fiction and speculative fiction. In a *Guardian Online* article, Margaret Atwood talks about why there is still a need for science fiction in all forms of storytelling but notes that we should be careful about the term 'science fiction', as it has different interpretations and is used for different purposes in fiction. The author draws on the distinction between science fiction and speculative fiction as an illustration of a distinctive form of the (sub)genre:

> If you're writing about the future…you'll probably be writing something people will call either science fiction or speculative fiction. For me, the science fiction label belongs on books with things in them that we can't yet do…and speculative fiction means a work that employs the means already to hand, such as DNA identification and credit cards, and that takes place on Planet Earth. But the terms are fluid.
>
> (Atwood, 2005)

In relation to the speculative elements in my creative work I can connect these to Atwood's thoughts on how speculative fiction fundamentally differs from science fiction.

As I have already touched upon, from the perspective of my creative practice, (genetic) science has been primarily used as a 'theme' rather than creating narrative fictions necessarily about science or scientists. My pieces are generally character-centred, situated both in a recognisable (Western European) UK society and in recognisable scientific environments (i.e. either in a 'laboratory', 'medical facility' or 'field' setting). The core aim of this research is to investigate if and how fiction can be successfully employed to present the empirical nature of science, scientists and the processes of undertaking genetic science. The key methodology employed by this study is the development of practice-based research designed to deliver a collection of 'speculative fiction' that brings together fictional scientific characters, their personal and scientific experiences, and a variety of accessible factually based science and genetic science content. It is hoped that in this collection some of the processes of science (specifically genetic science) can be delivered in an accessible manner that will engage an audience to follow both the narrative and the science with equal interest.

I refer to my creative practice as speculative fiction and do not regard the collection as science fiction. Adam Roberts in his text, *Science Fiction* (2000), offers a fundamental definition of what science fiction is: '…as a genre or division of literature [it] distinguishes its fictional worlds to one degree or another from the world in which we actually live: a fiction of the imagination rather than observed reality…' (p.1). With the collection I closely align the world of my fictions with that of a recognised reality and only deviate with near-future speculation of where the empirical science and proven scientific theories of today—of now—might take us as a society. The 'speculative' element comes from how the ideas (theories) and technology are employed (through the characters). In speculative fiction the ideas (theories) and technology exist in the present. My writing explores and exploits how, why and where these might be employed. As I have observed earlier, Atwood (2005) suggests that science fiction and speculative fiction are two entirely different approaches to writing fiction: one is the future, of things which are imagined, and the latter is based on concrete ideas or technologies which are presently at hand (in a contemporary society). From my creative practice perspective, I would agree with Atwood's assertion that speculative fiction is a discrete approach, as it is based on elements that have their basis in fact, in the here and the now.

In Niall Harrison and Paul Kincaid's writer-led survey-based BSFA[5] text, *The State of British Science Fiction and Fantasy* (2010), a clear distinction between science fiction and speculative fiction is very much in evidence. A cross-section of British science fiction and fantasy authors—both resident in Britain and British-born—were interviewed through two surveys taken twenty years apart on a range of related subjects. In the analysis of these surveys, a number of authors say that they regard their work primarily as speculative fiction, but all agree that it will nominally also come under the umbrella genre classification of science fiction, as speculative fiction is not either a well-known term outside of publishers or easily identified by readers. To help illustrate these findings, I use a sample of quotes from two of the authors Harrison and Kincaid interviewed. First up, writer Graham Dunstan Martin (*Gift Wish*, *Timeslip*) says, '"I prefer to describe my work as speculative fiction"', and qualifies this with, '"I always thought it [speculative fiction] was an excellent label, it had the right initials, avoided arguments about where science…ended and fantasy began…"' (p.11). And secondly, author of the *Maelstrom's Edge* series, Stephen Gaskell, says that he uses the term, '"…speculative fiction when talking about my own work…"', and goes on to state that, '"…speculative fiction, as a label, is not widely known outside of the community, and it immediately triggers a question in the reader's mind: what *is that*? This is very useful for re-calibrating people's expectations of sf and f"' (p.17). These quotes from Harrison and Kincaid's findings help to give an idea of the strength of feeling around drawing a distinction between science fiction and speculative fiction. It is a thread that is repeated across their survey of science fiction and fantasy authors.

As a concluding point to this section—speculating on fiction, content and genre—I would like to use a quote from the author, Nina Allen (*The Race*, *The Rift*), on her relationship to both science fiction and speculative fiction:

> If you were to ask me what I am I'd say a writer, and if you were to ask me what I write I'd say speculative fiction. I often feel my stories are not organised enough to count as "proper" sf – so if I am a science fiction writer I am a very wayward one. On the whole I am wary of genre labelling, because too often people either have preconceived ideas about what sf is or what it should be, which can lead to them either dismissing your work out of hand or else having false expectations of it. I understand that genre labelling can be useful…I just don't like it when these boundaries become too rigid.
>
> (Allen in Harrison and Kincaid, 2010, p.20)

[5] British Science Fiction Association.

I believe this sentiment encapsulates the current state of play regarding the restrictions placed on authors who write imaginative fiction and how this is categorised in order for it to be marketed and consumed.

Writing speculative science-as-fiction as one approach to a mainstream science literary fiction

From writing within a literature of ideas and possibilities, a 'What if?' method allows me to question science and resulting technologies as propositions to prompt thought and debate. These 'What if?' scenarios in my creative work are designed ultimately to be works of fiction that allow me to speculate about contemporary ideas in genetics. Tuttle (2005) considers this ability to ask the 'What if?' question from within a '…literature of ideas, of wonder and speculation' (p.3) that is often prevalent in speculative fiction and science fiction stories (but not exclusively so). I concur with Tuttle's observation as this 'What if?' question underpins the developmental approach to my fiction. The science behind the majority of my fictionalised scenarios is being applied authentically, so there is scope for my pieces to act as a focus for the discussion of genetic science and allows me to contemplate how this may impact in the (very) near-future.

Ailsa Cox in *Writing Short Stories* (2005), considers the 'What if?' question in relation to the writing of short fiction. Her emphasis on the short form is specific as she regards that the structure of a 'What if?' approach, '…so often turns on a single idea' (p.101). She says that whether it applies to speculative fiction—characterised by, '…downplaying the emphasis on scientific hardware and the geek image that used to be so off-putting…' (p.101)—or science fiction, it offers '…a great opportunity for you [the writer] to extend your imaginative range through a variety of styles and techniques' (p.101). Even though the emphasis here is on short form fiction, my longer form fiction—novelettes and the novella—do share the single idea structure of the 'What If?' approach, and with a focus on the human element over the scientific element. As an illustration, in my second novelette 'The Patient Experiment', the single idea or question revolves around whether death is reversible and the interplay centres on the consequences of this. The genetics and medical science offer extra narrative layers and are an integral and important part but have not been allowed to overwhelm the story. And finally, the main character, far from being considered a 'geek' is a hard-working professional researcher, who is grounded in reality and exists outside of the laboratory.

As discussed earlier in the chapter, there is a great deal of interpretation of the writing forms to be found in-between that of the short story and the novel. I use the forms of novelette

and novella to present single idea fictions, with additional layers of narrative incorporating scientific processes, ideas, techniques and personnel that are played out over specific longer periods of time (i.e. more than one scene or sequential scenes in a compressed time frame). This allows for character development, the plotting of a narrative structure through a chain of events leading to a resolution—as indicated by Amanda Boulter's use of Freytag's pyramid in her description of short story plots (2007, pp.38-9)—and changes in the situation of the main character, often with their future set on a new trajectory. These factors take the pieces in my collection out of the realm of the short story, in structural, narratological and physical terms.

In my approach to the writing of fictional worlds—albeit ones based on various contemporary locations and recognisable backgrounds—there is a need for accuracy, both in the development of storylines and in the ideas and progress of science issues present in my work. Without this attention to detail my fiction pieces would fall short of what I expect of them. In concentrating on whether my requirement for presenting an accurate scientific process is relevant or not, it does open possibilities of how this issue could be useful in communicating features of science, as it provides an opportunity for dialogue. It allows for ideas about new and proposed aspects of science to be aired and debated before the hard choices of reality must be made.

As an illustration to the approach taken to designing fictional worlds, I will outline the backgrounds to those worlds developed. Firstly, 'The Commuter Lab' takes place in and around central London, just north of the River Thames and west of The City. It is based on my personal knowledge of the factual area of High Holborn, The Aldwych, New Barnet and Moorfields. I tried to use the geography of these areas faithfully to help situate the narrative in a contemporary environment, to heighten any comparison to a perceived reality in the mind of the reader. In choosing the setting in which the tale unfolds as a familiar or recognisable one, I hoped that the scientific and genetic aspects might be more readily acceptable to a general reader. Secondly, with 'The Patient Experiment' I again chose a contemporary and recognisable but less familiar setting for the fiction. The piece takes place in two locations: Centre for Life Experiences (CLE) institute and its environs, and Jake's flat. Both are located on the outskirts of the City of Oxford, along the A40 ring road. Again, like the first piece this is a familiar landscape for me, so it is based on memories and current layouts of the area. I have tried to keep the CLE within the bounds of a contemporary medical facility based to some extent on my own experiences of working in several hospitals—including the Royal Liverpool, Moorfields and Gt. Ormond Street—and

background research into similar medical research facilities. In order for the fiction to work as intended, it was crucial to be able to persuade a reader that this facility could be operating in a contemporary environment. I felt that the medical science and genetics should be more integrated into the fabric of the story, so the majority of what is discussed by the characters regularly revolves around aspects of science, medicine and genetics. In the case of the final piece, 'A Common Thread', I was similarly able to draw on both geographic knowledge—South London and East Kent—for situating the plot and creating the right atmosphere, and a working/studying knowledge of university laboratories, working practices and environments. The practices and technology in this novella do take the reader beyond the standard laboratory equipment and procedures found in the first two pieces but it is still based on current empirical and theoretical genetic research. As with the other creative works, one of the main objectives is to create a familiar and recognisable world to help situate this story in, as I attempt to present a speculative or very near-future scenario within a recognisable and contemporary society. It is hoped that readers relate to what they experience and think about the consequences of the technology and its possible applications within the next few years. Being able to create a story-world in which this is possible helps to achieve this aim.

I have a commitment to represent science and genetic science in a factual light, through a fictional lens. Part of this responsibility comes from recognising that the (mis)understanding of science can have repercussions. The (media) portrayal of science is often directly relevant to this situation, as its commentary carries meaning and weight in a population's perception of science and associated technologies[6]. In my creative work it is important for me that the relevance and validity of the science can be established through how my fictional portrayal measures up against the 'hard'[7] science and genetic science breakthroughs, developments and applications in the everyday.

The ideas and storylines in my creative practice are aimed at audiences who are receptive to the possibilities, who will consider what they read and how these ideas may impact on themselves, in a contemporary and near-future setting[8]. I have purposefully kept my storylines and story-worlds within the realms of current and recognisable environments, to assist in heightening their dramatic impact (and again, relevance) and to relate the body of

[6] See the section in Chapter Two: 'A consideration of the sociology of (genetic) science in developing science-inspired fiction', for a more detailed discussion.
[7] For the purposes of this research study, 'hard' science is regarded as scientific study based either on solid scientific theory or empirical evidence.
[8] Three pieces of creative writing linked to my research study have been published in the following publications: *Thursday Identity*, *Holdfast Magazine*, *The Ham* and the *Honest Ulsterman*. These pieces are referenced individually in the Bibliography.

work as pieces of contemporary fiction. Although at first look, a number of the works in my collection could bear some slight resemblance to science fiction or science-fantasy, I would not categorise them in that way. They are speculative science-as-fiction, and to consider them otherwise would offset any prospective impact that the on-going PaR approach has the potential to achieve.

One method of encouraging the production of a more mainstream science literary fiction could be found in the interplay between science and scientists that delivers both a scientific stereotype and anti-stereotype, to act as a counter-balance. If a reader—for whatever reason, be it a general mistrust or a lack of interest in science and scientists—is unwilling to engage in a story that provides a scientist as its protagonist, then the counter-balance of a main character who is one-step removed from the associations of 'science' but still engages directly with its content and process, could be a way forward. This is a similar approach to one that I have adopted for the pieces in my collection and can be found across a range of contemporary science literary fiction from authors and books as diverse as John McCabe with *Paper* (1999) and Barrett with *Ship Fever* (1996), both of which have been directly influential on my creative practice.

As an attempt to define a fresh place for science literary fiction, Soren Brier (2006) puts forward a case for the establishment of a new fictional literary genre (as previously Carl Djerassi and Jennifer Rohn both have). Brier's new (sub) genre has been self-termed *Ficta*. He regards this as a development in scientific-drama which would sit one level below the futuristic leanings of science fiction but above the dramatization or fictional reconstruction of historical scientific events (normally termed 'drama-doc' or 'faction'). Although Brier regards *Ficta* as a new level of scientific literary drama, he felt that the genre already exists in all but name, as he counted the work of novelists such as Michael Crichton, Greg Egan and Umberto Eco amongst those who were already writing within the boundaries of the new genre. Brier considers that this new genre would be valuable within fiction writing to portray and examine discussions around a '...real scientific problem' (2006, p.153), as any such problem would both drive the construction of the narrative and be represented as integral parts of it. Brier sets out some basic parameters of *Ficta* as follows: the main subject or central character would be a working scientist; they would steer both the discussion of science and the narrative goal or object, and in turn be subject to the reactions of the counter (scientific) forces present in the narrative.

My approach is similar to Brier's apart from my preference would be to have an 'outsider' or fringe player as the central character. I found that this allows (me) more latitude in dealing

with issues of expressing scientific information and associated processes and helps to avert—as much as I can—an exposition overload.

Marcus Chown in his article, 'Is Science Fiction Dying?' (2008)—published as part of a *New Scientist* science fiction special—indirectly addresses this notion of the evolution of a new genre—or sub-genre—for science-as-fiction. Chown considers if the science fiction 'genre' can survive when (increasingly) science fact seems to be stranger than projected and fantasy fiction. In a response he puts forward a notion that if there is such a literary gap between science fact and science fiction, could it be filled by a different fiction than that categorised as 'science fiction'? So, if the reality of science is outstripping the imagination of science fiction, is there a vacuum of fictionalised and imaginative literature which describes and talks about this 'science' and its principles, methods and characters within a fictional setting that is not science fiction? Could this signal a move to a new literary genre that deals with science in literature but considers it in more of a holistic contemporary view without losing its power to describe—to speculate on—fictional scenarios of where science and technology may lead us? Reflecting on works by Doris Lessing (*The Sirian Experiments* (1980)), Ishiguro (*Never Let Me Go* (2005)), Malorie Blackman (*Noughts and Crosses* (2001)) and Haruki Murakami (*Hard-Boiled Wonderland* (1985)), Chown says, 'Sci-fi themes have infiltrated mainstream fiction too. The lines between what we define as science-fiction and "mainstream literature" may be increasingly *blurred*...' (2008, p.46). With this article Chown advocates an evolved approach that would have much in common with the notion of the development of mainstream science literary fiction, as a more freely recognised type or genre.

In the collection of articles that accompanies Chown's leading editorial, Ursula K. Le Guin sees beyond the classification of science fiction arguing that past speculation has failed to live up to the much more complex (contemporary) reality. As she suggests, 'Things are now livelier over on the social and political side, where human nature, which doesn't revise itself every few years, can be relied on to provide good solid novel stuff' (2008, p.47). Le Guin questions the firm distinctions drawn between science fiction and other literature including realism and considers that this is more fluid than the publishing houses would have us believe. She comments that science fiction can be at one end of the spectrum as space-opera fantasy but at the at the other end, its speculative nature can encompass an alternate-reality contemporary present alongside imaginative works as diverse as China Mieville's *Perdido Street Station* (2000), Michael Chabon's *The Amazing Adventures of Kavalier and Clay* (2000) and Philip K. Dick's *The Man in the High Castle* (1962).

Perhaps the best platform for science-as-fiction writing is likely to be found in the character-based social and political features, as these tend to shift at a slower pace and are

more predictable than the places to where any technological applications of near-future science and technology may transport us, within relatively short periods of time. This approach is established in the three pieces of my collection: In 'The Commuter Lab', the resultant danger from genetic science and technology for the protagonists—Pete, TT and Amy—is that the covert societal experiments have been exposed and the consequences for them are severe; with 'The Patient Experiment', Jake's conscience and moral compass is manipulated through the exploitation of medical science for the CLE's financial and political gain, and in 'A Common Thread', Judith's professional position and genetic material are manipulated to put her in an untenable position from which she kicks back. So, is this where the notion of a mainstream science literary fiction would be more adaptable: to engage with a contemporary reader's imagination at an intimate political and social level rather than a remote, unfamiliar world that is too removed from what they know and what their experiences are? This could be more appropriate to the current age we live in: where chaos and order seem to exist in tandem, in the same place at the same time.

As a final thought for this discussion on the prospect of considering speculative fiction as a mainstream science literary fiction, is the model of the incredible success—mostly in Young Adult—of 'dystopian' fiction. This may provide an indication that the next generation of adult readers will be open to accepting a character-based, social and political approach (as mentioned above) for any mainstream science literary fiction. This is especially the case if this deals in recognisable worlds and characters embroiled in situations—set in the very near-future—that either speculative science and technology has facilitated or holds the solution to, much as *The Hunger Games* (Collins, 2008) or *Divergent* (Roth, 2011) situates their readers in recognisable but failed societies with characters and situations to both empathise with, and to be fearful of.

Structuring scientific enquiry within the creative process

There is perhaps a related reason why science fiction thrives as genre fiction and science-as-fiction literature struggles to gain recognition as serious and literary. The writers and producers of science fiction utilise science and technology in a very creative way without being restricted to re-presenting science in a more factual light. From the perspective of science-as-fiction, unless the findings and implications are put into either a real-life context (in a dramatic form) or put into an existing and interesting narrative genre form, such as a thriller or historical-type work—as Simon Mawer with *Mendel's Dwarf* and Eco with *The Name of the Rose* have done respectively—an entirely factually correct narrative in a non-

dramatic fictional style may only have limited appeal. This has been an issue in creating meaningful and readable science-as-fiction[9].

Considering a selection of science-as-fiction literature[10], a structure which seems to work effectively is one which affords the reader (and author) hindsight. For instance, one approach is to set a piece in the distant past and to engage with a well-documented or lesser-known (but well-researched) event or scientist's work. A modification of this approach is to partially set the story in the near (or distant) past within a dual narrative format. This is then brought into a contemporary space through a narrative device such as a memory, a physical memento or a piece of evidence (for example, a letter or journal) that is itself somehow linked to the present by (a) character(s) within the storyline. Barrett's 'The Behaviour of the Hawkweeds' (in *Ship Fever*) offers an effective example of this structural approach.

This observation is an intriguing one, as science-as-fiction literature could be juxtaposed with those formal structures found within science fiction replacing the 'past' with the future or speculative (near-future). From this it may seem as though science and scientists, as the main content material across different types of fiction, work most effectively in either the past or the future with quite a large gap found in the contemporaneity of the here and now. Whether this is an inherent issue with the setting of a science-inspired tale in a contemporary environment, it is probably the place of a further (critical-based) research study to consider. There are however specific examples which have challenged this trend in the past—in part due to economic and political circumstances—and can be seen in the rise of (the then) contemporary science-as-fiction novels written from the early 1930s up to the mid-1950s (which incorporates the 'Collectivist' era of over-arching state control of industry). This period of science-as-fiction writing—for want of a better descriptive label—is extensively documented by Nicholas Russell in his article, 'The New Men' (2009). According to Russell, it would seem as though the period of post-war, wartime and depression which industry and the economy went through (both in the UK and USA) was a fertile ground for writers and readers of contemporary science-as-fiction. There were successful contributions to the 'movement' by UK authors such as: 'A.J. Cronin; E.C. Large; C.P. Snow; Nigel Balchin and W.

[9] For further discussion see thoughts from both Gaines (2011) and Rohn (2010b) that I have previously commented upon.

[10] A sample of this corpus selection is provided below, to give a flavour of the works considered:
Barrett, A. *Ship Fever* (Collection) (1996).
Gaines, S.M. *Carbon Dreams* (2000).
Goodman, A. *Intuition* (2009).
McEwan, I. *Saturday* (2005).
Mawer, S. *Mendel's Dwarf* (1997).
Rohn, J. *The Honest Look* (2010).

Cooper (under the pen name of H. Summerfield Hoff)' (Russell, 2009, p.35), that resulted in a range of novels of varying critical and/or commercial success[11].

This 'past or future' issue may be investigated further by a consideration as to why many science-inspired fictions are located in the past. In already knowing the full details of the science (and its outcomes), and then positioning this in the timeframe of the past (science-as-fiction literature), a firm foundation is offered on which to construct a rounded story. So, following on from this in terms of addressing contemporary and near-future effects of science, it is through imagining (with a certain creative license) how contemporary (science-as-fiction/speculative science-inspired fiction) or future (science fiction) science discoveries will affect a given society. The main consideration with this approach would be the use of an element of creative imagination within the practice, which would itself seem to be in opposition to the notion of the scientific process that science-as-fiction tries to re-present.

Within the specific pieces of my creative work, scientific enquiry is linked both to the object—taken as the main character to whom the science/genetic engineering is (physically) happening to—so, the characters of TP in 'The Patient Experiment' and Judith in 'A Common Thread', and to the subject—taken as what is being sought in respect to scientific/genetic aspects of the storyline—of those individual fictions. The approach I have taken to writing offers, as a feature of the storyline, the chance to sample both a taste of participating in a (fictitious) scientific enquiry, along with the experience of what it would be like to be at the centre of that enquiry, through empathy with specific characters and their environments.

Approaching my research study initially from a science communication[12] base rather than from a literary one, it became clear that the more formal methods to engage different types of audiences with scientific ideas and methods of working often fell short of their original intentions. This inconsistent approach was, and still is, highlighted both by social scientists and scientists themselves, questioning the value and claims of scientific knowledge[13], particularly against the tragic background of instances such as MMR, BSE and SIDS[14]. Thankfully, some of the current debates such as those surrounding the advent of 'three-

[11] These include Balchin's *The Small Back Room* (1943) and A.J. Cronin's *The Citadel* (1937).
[12] 'Science communication' comes in many forms and guises. Its nature and terms of reference are still much-debated. For a concise, balanced consideration of what science communication is, could be and how it can be framed, see the concluding chapter of Gregory and Miller's 1998 book, *Science in Public* (pp.242-250).
[13] See Chapter Two for a fuller discussion concerning 'Science Wars' and 'The Strong Programme'.
[14] Measles, Mumps and Rubella (infant vaccinations); Bovine Spongiform Encephalitis (in cattle), and Sudden Infant Death Syndrome, respectively.

parent designer babies'[15] has been more balanced. A satisfactory outcome of my practice would be to produce a (post-doctoral, research-based) piece of fiction—within the field of science communication—as an opportunity to engage non-specialist readers with aspects of the genetic scientific processes, in an entertaining and thought-provoking manner.

From the beginning of this research study one of my main concerns for the creative practice has been—and still is—to represent an empirical scientific process that stands up to professional scrutiny, which offers a reader pieces that are not didactic in nature but are informative and are able to be engaged with as contemporary fiction. I will not pretend that to achieve anywhere near this goal has been simple: it has not. The following quote from Crichton appears at the start of *The Andromeda Strain* (1969) and succinctly encapsulates the path I have tried to navigate:

> This is a rather technical narrative, centring on complex issues of science. Wherever possible I have explained the scientific questions, problems and techniques. I have avoided the temptation to simplify both the issues and the answers, and if the reader must occasionally struggle through an arid passage of technical detail, I apologize.
>
> (Crichton, 1969, p.12)

How my contemporary speculative science-as-fiction relates to a wider (critical) context of fiction, science fiction, science-fantasy and speculative fiction.

The approach taken to producing my creative practice for this research study has generated questions concerning the structural form (literary or genre), the length (shorter or longer) and genre style (science fiction, science-fantasy or speculative fiction) of the work produced. To establish a clarity of meaning as to what style my research practice is, it is speculative fiction that delivers current science in a contemporary narrative format. As discussed in this chapter, there are a range of stylistic elements to be found in my creative work but collectively the practice is closest to speculative fiction. The individual pieces were originally conceived as part of a contingent of twenty speculative science-inspired ideas. So, although each idea was developed with questions concerning factors such as scientific subject, contemporary or historical setting, a scientific or non-scientific character as the main protagonist, the pieces chosen to be fully realised as the research practice—once selected—

[15] So-called 'three-parent designer babies' (or simply 'designer babies') are one of the main current subjects of discussion and concern in genetic science. A central ethical issue is focussed on alterations to the 'germline'—or inherited DNA—of the baby and subsequently their ancestors. For a concise insight into the effects of 'gene editing' techniques, see Penny Sarchet and La Page (2011).

were developed through an organic process with a specific purpose in mind: to produce a collection of contemporary genetic science-inspired speculative fiction.

My initial intentions were to try to write near-future or contemporary science-as-fiction pieces without tying them down as either science fiction, science-fantasy or speculative fiction, short stories or longer pieces or specifically belonging to literary or genre fiction. My selected pieces were written around characters on the fringes of science and genetic research, with ideas and situations (often) taken from factual science and the practice of factual science. The fiction in each of the three pieces—in my collection—is allowed to develop in order to tell the main characters' stories with regards to the ideas and situations they are confronted with. In all cases, each is the tale of the main character's reaction to the situation in which they find themselves. With this in mind, the finished pieces form a collection which do mix formal styles and genres. The presented versions of my individual fictions and their lengths are an incarnation of the way the pieces needed to be told and what needed to be told in them. In devising and progressing this research study there was an implicit understanding that the normal commercial restrictions of writing for publication (i.e. fixed lengths, specific form and a specific style) were not at the forefront of any list of criteria. This artistic freedom has allowed me to produce pieces of creative writing that deal with science-as-fiction set against factual backdrops but with elements of speculation around the science and its use, that both exhibit factors of literary fiction (more character-centred) and genre fiction (more ideas/situation driven) and so (for this research study), occupy a non-standard or middle-ground—space—between the two broad formal categories of literary and genre fiction. Science-as-fiction is not a genre or sub-genre as such, and I acknowledge that my practice would fit into more than one style or genre; the main aim is to explore through the writing of fiction (and the development of characters), the processes of undertaking and engaging in empirical (genetic) science. From this perspective, the practice sets out to examine the possibilities of fiction.

In defining genre types, Suzanne Keen in her analytical text *Narrative Form* (2003), argues that the 'theme' of the text is an important aspect when examining 'generic difference' (p.143), partly because so many genres share and mix themes. This observation is apparent in my own practice. 'The Commuter Lab' exhibits themes of thriller, science fact, empirical science, contemporary, urban, state control, science speculation and social science fiction[16]. Keen says themes (such as these) represent '…those ideas that connect literary

[16] Fiction that broadly considers the effects of science and technology on society.

representations and the broader world of human concerns and experience…' (p.143). Maybe it is through the themes of my fiction that the most appropriate classification should come.

Janet Burroway and Elizabeth Stuckey-French in their book *Writing Fiction* (2007) provide a succinct examination of the more prevalent styles and genres present in contemporary fiction writing (pp.413-6). They draw clear distinctions both between a literary and genre approach (in terms of content and sophistication), and then between the different types of genre fiction writing. There are two broad approaches in this text that help to define how I have developed my own practice. The first is that my structural approach has been to create character-driven pieces, which according to Burroway and Stuckey-French (p.413) would seem to suggest my practice falls within the broad remit of literary fiction. And secondly, a consideration of whether my practice should be considered as genre fiction (under a broad distinction of science fiction).

Burroway and Stuckey-French, argue that the category of science fiction (like that of detective fiction) '…deals with ambivalence about technology, the near miraculous accomplishments of the human race through science, the dangers to human feeling, soul and environment' (p.414). They add that it '…usually deals with some problem that can be seen to have a counterpart in the contemporary culture…' (p.414). This is by no means a definitive statement about how science fiction can be either categorised or defined but it does offer a useful starting point. However, if my pieces are 'tested' against the different aspects of these definitions, a similar outcome to that of testing for the type of fiction is likely to be reached: some are true, others are in opposition. For example, in 'A Common Thread' there is ambivalence to the use of technology with Judith's attitude to the professor's methodologies in his attempts to restore DNA samples, whilst in 'The Commuter Lab' TT is seen to have an informed disregard for the scientific establishment, its procedures and its regulations on who can legitimately use of the available technology. This comes out through his interactions and conversations with Peter. Despite this, in both these fictions and 'The Patient Experiment', the science (and technology) I am presenting is not meant to be analogous to present-day technologies: it is the contemporary science and technologies of genetics[17]. Taking this into account, there are some elements that have science fiction leanings and some which do not, so again a simple definition of my works as genre fiction (in this case, science fiction) would not truly fit. I suggest the space in-between is where the speculative fiction espoused by

[17] In an article by Tom Ashbrook (2017), 'A Gene Editing Breakthrough', detail is provided of a successful experiment on embryonic DNA to 'repair' damaged DNA by extraction and replacement in a parallel technique as applied to that of Edmond's 'presence' in 'A Common Thread'.

Atwood, Margaret Drabble and (early) Crichton—and the social science fiction of Le Guin and Stephenson—is to be found.

In considering questions of genre, John Gardner in *The Art of Fiction* (1991) advises that writers should look to engage a reader or to tell a story which is first and foremost believable and could have happened within the bounds of that fiction's story-world. He says that it is '…the writer's first job to convince the reader that the events he recounts really happened, or to persuade the reader that they might have happened [or could happen]…' (p.22). Gardner examines verisimilitude with regard to constructing a realistic or contemporary and recognisable world for a story to operate in. With the approach taken to my individual fictions, I combine Gardner's method of writing people (characters) and places that are recognisable and familiar, with the practicalities of scientific processes that would be recognisable as aspects of contemporary science (undertaken by scientists). In combining this verisimilitude with the technology of a contemporary society, my aim is not to produce work which could easily be categorised as science fiction or fantasy, as there is more of a contemporary and real-world context—or 'documentation' as Gardner refers to it (p.23)—to my practice which positions it outside of the aforementioned standard generic types. I would refer to my writing as broadly 'speculative contemporary fiction', leaving detailed categorisation to be decided on by its potential readership.

When it comes to specifying a genre in my attempts to categorise (my) science in literature (science-as-fiction), commentators such as David A. Kirby, Frans Saris, Rohn and Ruthanna Gordon *et al.*—all of which I have considered in this rationale—add valuable and persuasive arguments. However, one writer and commentator who succinctly describes the category that I feel best fits my practice is Atwood. I have used this point earlier in the chapter but its relevancy (for my practice) is worth stating again. With Atwood's article for *The Guardian* (2005), 'Aliens have taken the place of angels: Margaret Atwood on why we need science fiction', I agree with the author's assertion that science fiction and speculative fiction are two entirely different approaches to writing fiction: one is the future, of things which are imagined, and the latter is based on concrete ideas or technologies which are presently at hand (in a contemporary society)[18]. This helps to illustrate why I refer to my work as 'speculative' because I do not regard it as either science-fantasy or science fiction—as in terms of ideas and technology the wherewithal exists now—my writing explores and exploits how, why and where it might be employed.

[18] See earlier in the chapter for the original quote from Atwood (2005).

Although I would not exclusively identify my work as such, there is another refinement for speculative fiction whose origins can be traced to Le Guin. The author offers a further distinction for types of speculative fiction that could be classed as social science fiction. In an interview for *The Paris Review* (John Wray, 2013) Le Guin explains her motivations and approaches to storytelling in this form of 'science fiction' and how it is a different view to writers such as Asimov or Clarke:

> The "hard"-science fiction writers dismiss everything except, well, physics, astronomy, and maybe chemistry. Biology, sociology, anthropology—that's not science to them, that's soft stuff. They're not that interested in what human beings do, really. But I am. I draw on the social sciences a great deal.
>
> (Le Guin in Wray, 2013)[19]

I agree with Le Guin's approach to using sciences (in fiction) in a more holistic way. My practice centres on scientific characters that exist in a recognisable society and deal with contemporary science. Their actions have consequences within and outside of their immediate environment. All of my pieces have genetics at their core, but they also individually involve general biology, physiology, medicine, anthropology, clinical medicine, physics and chemistry amongst others. Mirroring Le Guin's approach, I use their (social) backgrounds, skills and approaches to life to help shape the outcomes of their actions. Speculative fiction, according to Arthur B. Evans (Mark Bould *et al.*, 2009) has been a companion of fantastic fiction and latterly science fiction, since its (early) post-industrial revolution beginnings in 1771 with the publication of Louis-Sebastien Mercier's futurist utopia, *The Year 2440*. Even before the term 'science fiction' was coined during the early twentieth century heyday of American-led pulp fiction, Evans proposed that:

> …a recognizable literary tradition was, according to many critics, conceived during the industrial revolution and born during the latter half of the nineteenth century in Jules Verne's *voyages extraordinaires* and H.G. Wells's *fin-de-siècle* "scientific romances". These two sf variants pioneered by Verne and Wells (hard/didactic versus speculative/fantastic) became the two major modes that have dominated the genre ever since.
>
> (Evans in Bould *et al.*, 2009, p.13)

[19] There are elements of the distinction between 'hard' and soft' terms in my own practice although I use them in slightly different ways. I use the terms 'hard' and 'soft' to refer to the levels of complexity with which the material was presented.

This succinct reading of the historical roots of both science fiction and speculative fiction does indicate the initial differences between the two main approaches to fiction characterised by its relationship to science and technology, and the subsequent styles derived from this dichotomy. Whilst this distinction is helpful in looking for a definitive answer as to what the precise differences are in a current sense, my own approach to this type of fiction has been to write a mix of contemporary pieces which cross these definitive boundaries, as elements of my research practice can be regarded as both didactic and speculative (at once 'hard' and 'soft' in the lexicon of science fiction).

Evans highlights a key factor in the distinction of these two (early) established modes of science fiction. Using this he places writers such as Verne on one side with Wells on the other. The fundamental distinction (for Evans) is in how the narrative uses or is used by science. He says that '…Verne's narratives sought to teach science through fiction, not to develop fiction through science (or, in many instances, pseudoscience), as in the case of Wells, Rosny, and other early practitioners of speculative/fantastic sf' (2009, p.17). Evans suggests that through a close-reading analysis of the narrative structure (in the early works of the genre), the role of the 'science' in a story (fiction) can be determined: 'i.e., the manner in which a sustained scientific discourse is grafted onto a literary one' (p.17). From this analysis Evans concludes that '…the primary goal of the science in speculative/fantastic sf is more expositional: to facilitate plot progression…to build verisimilitude' (p.17). This clear distinction between the two modes establishes both the position of science within a narrative and the form of its use by the narrative. So, from Evans' position the 'hard'/didactic approach to science in fiction writing as championed by Verne, can be regarded as the primary focus of a fiction designed to address the intellectual, inspirational and educational aspects of a reader. Whilst the 'soft'/speculative/fantastic approach to science in fiction writing as typified by Wells, is regarded as a secondary concern with its function primarily directed at appealing to a reader's 'creative imagination' (2009, p.18). This reasoned conclusion does seem very cut and dried but is still more or less valid despite the genre of science fiction becoming very fractured across many sub-genres (or modes or types), beyond even the concrete divisions of 'hard' and 'soft' categories formulated during the latter half of the twentieth-century.

To help contextualise my own work in this debate, the fiction presented in my collection relies on a speculative approach. My storylines look to engage a reader's imagination, not to ask the reader to suspend disbelief as they are introduced to a different world or a unique race of beings, or even planets with an unusual ecosystem but in a closer, imaginative way. I ask readers to imagine creatively in a contemporary society what would happen if a

biological agent could be engineered at a genetic level to target and attack a specific group ('The Commuter Lab'), or to contemplate a level of control over the physicality of life and death through genetically altering the cellular make-up of our bodies ('The Patient Experiment'), or the faithful re-creation of a virtual form and personality of a long-dead human being, capturing the spirit or essence or soul: the precise thing that makes us human ('A Common Thread').

Presenting my research practice

Due to the nature of my collection containing fictions of mixed (longer) lengths that range from novelette to novella[20] there was some thought given to 'repackaging' my work as defined episodes or sequences, to present them collectively as a 'story-book' or 'novel-in-stories'. This did seem to be an attractive proposition to identify what my fiction collectively represented, as the pieces were designed to be connected by the specific and non-specific technical processes of undertaking genetic science. However, as I did not wish to overstretch the connectivity, it was decided to present the collection as distinct pieces linked through elements of ideas, content and structure.

As my creative work stands, what is offered is a collection of contemporary tales examining how the practice of empirical genetic science will have far-reaching implications in ways that can be both related to present-day situations (and real-life events) and imagined in the very near-future. My collection encompasses a range of fiction that begins in 'The Commuter Lab' with the basic tenets of undertaking genetic science and builds on this knowledge and understanding within each piece of the collection as it progresses. My final piece—the novella, 'A Common Thread'—is able to be freer of the mechanical detail of undertaking the processes of genetic science (precisely because of its interconnectivity), so is able to ask searching questions on the ethics and the morality concerning the present and very near-future uses of genetic science[21], whilst toying briefly with the fringes of magical realism (in the way that Atwood and Drabble do so effectively).

Closing chapter statement

[20] See earlier discussion in chapter concerning the development of my pieces when I used the terms 'long story' or 'long short story' as an intermediate descriptor, for what I now refer to as a novelette.
[21] Offered as illustrated examples. Ethically, should emergency experimental procedures be carried out without prior consent? Morally, do scientists have the right to monopolise genetic treatments in medical science, as they have in Western medicine?

A central aim is that the approach I have taken offers a contribution to knowledge and understanding in the growing PaR area of the creative arts. At its core is a method of engaging audiences (readership) with a content and a style that is designed to be different from what would normally be experienced. To accommodate this, the content of science and genetic science has been kept within recognisable boundaries, in line with that of a detailed broadsheet news report or popular (but informed) magazine article. In addition, this research study offers scope across the area of science communication with a contribution to a general knowledge of scientific process and the undertaking of science and genetic science, examined through creating contemporary fiction.

With reference to earlier discussions concerning Le Guin and Keen's understanding of social science fiction as a sub-category or type of speculative fiction as evidenced (partly) in works such as: *Fahrenheit 451* (Ray Bradbury, 1953); *The Left Hand of Darkness* (Le Guin, 1969); *The Handmaid's Tale* (Atwood, 1985) and *Snow Crash* (Stephenson, 1992), I propose that my collection could in part be further classified as social science fiction—under the umbrella of speculative fiction—as the pieces do consider the effects of science and technology (through the experiences of the characters) on particular areas of society.

In Chapter Two, I look to evaluate the constituent elements that I consider to be essential considerations when writing speculative science-as-fiction from within a contemporary literary and scientific setting.

CHAPTER TWO
The writing of (genetic) science-as-fiction in the context of a scientific environment

The main challenge for this research was to produce a body of creative practice within a specific framework of requirements: contemporary; a view into science and genetic science; authentic; relevant and plausible. This tailored approach was designed to infuse the resulting fictions with the practices and processes of science, and the notion that these are open and accessible to everyone to take an interest in, however fleeting. With this in mind, I position my creative writing research practice within a scientifically focused academic and theoretical context, which details the subjects and approaches I use in the production of my creative work, as a research collection of informed genetic science-inspired fiction.

The following exploration is arranged across five main areas: the nature of the fictional scientist, constructing fictional scientists, philosophy of science, sociology of science and communicating scientific knowledge. These areas are all in direct relation to my practice-based writing research of contemporary genetic science-inspired fiction. In addition to these is an extra section that considers two further areas: contemporary related academic and practice-based research, and where my research approach sits in a developing field of science-as-fiction in literature[22]. This places my practice-based research study into an overall context within a creative practice theme of constructing character-centred fiction that considers contemporary and forward-facing genetic science in a credible speculative format.

A consideration on the nature of the fictional (genetic) scientist in writing contemporary science-inspired fiction

With an emphasis on genetic science and scientists for all of the five areas under consideration, this initial category questions the nature of fictional scientists, and considers (through these fictional constructs) what their author's motivations could be for the characters' actions.

From recent studies of scientists in fiction, notably by Roslynn D. Haynes (2003), Brier (2006) and Jon Turney (2009), there is recognition of an image of fictional scientists, in a popular-culture frame that often leads to their portrayal as self-serving, morally vague characters of dubious motive. Both Turney (2009) and Charlotte Sleigh (2011) comment that the literary image of scientists is now starting to be re-addressed in the light of contemporary

[22] To qualify, the term of 'literature' is used here to encompass the range of styles and approaches which fiction could take.

works by authors such as William Boyd (*Brazzaville Beach*, 1990), Ian McEwan (*Saturday*, 2005) and Richard Powers (*Generosity*, 2010). This trend which features scientific characterisations along with aspects of professional science and scientific research subject matter (including a high proportion of genetic-based material) continues to thrive with a range of successful novels represented by authors and works such as Allegra Goodman (*Intuition*, 2009), McEwan (*Solar*, 2010), Edward Docx (*The Devil's Garden*, 2011), Richard P. Marshall (*Antisense*, 2013), Barrett (*Archangel*, 2013), and Tracy Chevalier (*Remarkable Creatures*, 2009). The nature of a fictional scientist's character is both an important aspect of creating a plausible fictional scenario for science to take place in, and in establishing a sympathetic protagonist which readers may identify (and even empathise) with.

Haynes (2003) identifies a 'Pandora stereotype' (p.251), which she considers as the default position for the portrayal of scientists in mainstream fiction. She argues that this could be standing in the way of more socially acceptable (and sympathetic) science-inspired fiction, which features scientists, their work and their private lives, alongside that of lawyers, journalists, forensics officers, police officers, detectives and doctors, as recognisable (professional) protagonists existing in a fictional world.

Within popular literature the portrayal of the fictional scientist from the Romantic period to the present-day, can be traced back to two points in the culture of the nineteenth century: a speculative scientific fiction and a theoretical scientific non-fiction. In 1818 Mary Shelley's *Frankenstein: Or, the Modern Prometheus* was published, with its eponymous central character Victor, a proto-scientist (natural philosopher) possessed equally of madness and genius, presented as a man willing to abandon his humanity in search of 'empirical truth' (in this case, the (re)creation of life). Forty-one years later in 1859, when Charles Darwin (based on work with and independent of Alfred R. Wallace) published their joint theory of Evolution to The Royal Society, it reached both a generalist audience (due in part to an established print media), as well as the specialised one it was originally intended for. According to Gillian Beer (1983, p.149) *On The Origin of Species* (1859) had a tangible effect on popular, published fiction from that era as it focussed the attention of established authors such as George Eliot, Thomas Hardy and Charles Kingsley to include aspects of the new theory in both the structure and content of their post-Evolution works such as *Middlemarch* (1871), *Tess of the d'Urbervilles* (1891) and *The Water Babies* (1863) respectively. Throughout the following twentieth century, the view of the 'scientist' was shaped through a popular culture which was best suited to use the image and pre-conception of the scientist and science, to imaginative extremes, through the genres of science fiction and fantasy, across the forms of

fiction novels and stories, pulp fiction, comic-book fiction and the film and television industries. By the end of the twentieth century and on the cusp of the twenty-first, the image of genetic science and the 'genetic scientist' had fared no better. Referred to as 'Frankenfoods' in 1992 by a Boston college professor Paul Lewis[23], genetically modified organisms (GMOs) were the subject of many newspaper and media outlet headlines (and continue to be so with the ethical and societal issues surrounding GM crops). However, in the beginning years of the twenty-first century there appears to be a more concerted effort on behalf of scientists, governing bodies/councils and the media to provide (medical) genetic science with the opportunity to help an often-sceptical public gain the information it needs to make an informed decision. This sea-change had emerged in the so-called 'designer babies' debate and is happening currently with the very recent emergence of the *CRISPR-CAS9* gene editing-technique[24] (launched in 2012 and first used on human embryos in April 2015). Understandably, this technique and the issues surrounding it are now present amongst many genetic-related news and related feature items. In part, the marginal (positive) shift in the media's attitude in reporting on the *Crispr-cas9* may be due to the medical contexts in which this breakthrough genetic science and resultant technology will be used.

According to Haynes, contemporary (literary scientist) authors such as Susan M. Gaines (*Carbon Dreams*, 2000), Rohn (*The Honest Look*, 2010) and McCabe (*Paper*, 1999 and *Snakeskin*, 2001) who consistently produce science literary fiction (aimed at the mainstream), try to offer a more balanced view of science and scientists, presenting both the positive and the negative, and are '…concerned to engage with the process of "doing science" and to indicate realistically how actual scientists think and behave in the intense atmosphere of a research laboratory' (2014, p.6). In contrast, more generalist literary writers such as McEwan (Solar, 2010 and *Saturday*, 2005) or Boyd (*Brazzaville Beach*, 1990 and *Ordinary Thunderstorms*, 2009), or genre fiction writers such as Kathy Reichs (*Grave Secrets*, 2002) or Neal Stephenson (*Zodiac*, 1988 and *Reamde*, 2011) make use of scientific characters and protagonists but not always in the most sympathetic manner, and not always in the interests of presenting (genetic) science in the best light. As Haynes (2014) points out, McEwan has

[23] Aneela Mirchandani (2015).

[24] The *Crispr-cas9* gene editing technique makes use of a biological function of the cellular defence mechanism, in which a cell replicates the code of the attacking bio-organism. This is used as a 'key' to unlock the code (break open the chain), with the aid of a protein called *Cas9*. See articles by Sarchet and La Page (2011), and Heidi Ledford (2016) for discussions on human genome editing and *Crispr-cas9* gene editing, respectively.

both used sympathetic and caricatured approaches to his fictional scientific protagonists, to suit the demands of his respective storylines. In his 2010 novel, *Solar*, the main protagonist (Michael Beard) is a self-serving and duplicitous research physicist who sees nothing wrong in furthering his flagging research career by any means. In contrast, the neurosurgeon character (Henry Perowne) at the centre of McEwan's 2005 novel, *Saturday*, is presented as a good person in all senses of the word according to Haynes' critique of the novel's main protagonist:

> In this highly sympathetic portrait, McEwan explores the subtle interaction between Perowne's scientific rationalism, his compassion, his deep emotional relationship with his wife and adult children, his sense of his privileged social position….
>
> (Haynes, 2014, p.6)

Whilst in the case of the genre fiction writers, Reichs' pathologist-detective main character, Dr. Temperance Brennan in *Grave Secrets* and Stephenson's battling environmentalist character, Sangamon Taylor in his novel *Zodiac*, exhibit the trademarks of being scientists but without undertaking much science beyond the procedural aspects of their respective professional interests. Often, the focus for these characters is on driving the story forward through plot revelations rather than extensive observations and insights into being a scientist/researcher. The point here is that the more generalist writers (of both literary and genre fiction) tend to use the scientist/researcher template as a means to an end, rather than trying to portray an authentic scientist (as much as it is possible to do with a fictional character), where there would be both positive and negative aspects to their personalities and actions. This balance is illustrated through the main character of Dr. Darren White in McCabe's *Paper*, a disillusioned DNA laboratory researcher, who is good at his job but is being driven to unpleasantness and insanity by its tedium. Ultimately, he must undergo a whole life shift in which he examines his relationship to science, to regain his purpose, identity and sanity.

In either paper, 'From Alchemy to artificial Intelligence: stereotypes of the scientist in western literature' (2003), or 'Whatever happened to the "mad, bad" scientist? Overturning the stereotype' (2014), Haynes does not propose any special treatment in the portrayal of realistically fictional scientists. Instead she calls for a fair and balanced representation,

somewhere in between the virtuosity of McEwan's character of Perowne and the inhumanity of H.G. Wells' sinister Dr. Moreau[25] [26].

As a starting point for this, it is worth noting that in the discussion of scientists, science and contemporary fictional literature, the North American author Djerassi (bio-chemist and inventor of the contraceptive pill) wrote his novel *Cantor's Dilemma*, in a newly self-termed style of 'science in fiction', in 1989. Djerassi helped pave the way of the scientist-turned-novelist, in the area of plausible science and contemporary fiction. This was followed up with a collection of novels and, latterly, plays dealing mostly with the 'business of doing science'. Since then, other scientists-turned-novelists (or literary scientists), have added to Djerassi's initial work across a whole range of different fictional (but factually based) scenarios and settings (including 'Lablit'[27], a collection/grouping of predominantly scientist-originated fiction hosted online). While contemporary authors such as McCabe, Rohn, Goodman, McEwan, Barrett and Stephenson all write about the practice of doing science, in a popular fictional format, there remains something of a barrier to the presentation and marketing of popular fiction which deals with this topic[28].

The challenge was taken up by one of these authors, Dr. Jennifer Rohn, a practising scientist and founder of *Lablit.com*, an online hub for all things 'laboratory and fiction' launched in 2005. (The term Lablit was originally self-coined by Rohn in 2001.) Rohn states that, '*Lablit.com* is dedicated to real laboratory culture and to the portrayal and perceptions of that culture—science, scientists and labs—in fiction, the media and across popular culture' (Rohn, 2005, p.1). According to her, *Lablit.com* was partly set up to redress the pervading stereotyped image of both science and scientists as presented through the mainstream media and to champion the cause of artistic creativity in the world of science and bring this to a wider audience. Rohn argues for Lablit as a standalone genre but in my research, such a definitive consideration is impractical. As I have encountered with my research practice, the factually inspired science-as-fiction form crosses traditional boundaries of genre and of style. In the world of book publishing, the concept is something of a maverick.

[25] Wells, H.G. *The Island of Dr Moreau*. First published in 1896.
[26] Further investigations may look at the sociological and philosophical considerations of how portrayals of genetic science/scientists and the culture of science are represented.
[27] See Rohn (2005) *http://www.lablit.com*.
[28] Although the work of the popularly successful author Michael Crichton would fall into this category his work had, and continues to have, a market of its own outside of the Lablit oeuvre. Works such as *The Andromeda Strain* (1969), *Jurassic Park* (1991) and *Prey* (2002) would still fit into the family of novels about the practices of science and its associated technologies.

Harry Collins and Trevor Pinch in their seminal study, *The Golem: what you should know about science* (1998), recognise that the 'authentic-world'[29] narratives of the science process provided through professional factual media (scientific journals/papers, science communication media, etc.), often concentrate on scientific method, acquisition of knowledge and potential applications, and rarely presented (if at all) an accurate enough representation of the process of undertaking scientific study. The 'authentic-world' narratives offered by factual media are (understandably) primarily fact-based, clearly argued and accurately laid out. They are mostly free from the value-judgements and the sorts of socio-cultural, ethical and moral concerns which can be experienced through the personalities and characters of fictional scientists in literature, such as Dr. Darren White in McCabe's contemporary science novel, *Paper* (whose chapters adroitly follow the form of an academic science paper). With their (popular-leaning) approach, Collins and Pinch present clearly laid out examples which go beyond the 'authentic-world' narrative of the factual science communication media. These describe the ideas and approaches behind the process of undertaking a scientific investigation. In their own way, Collins and Pinch highlight the possibilities and rewards of using dramatic literary fiction to explore the influence which science and scientists have[30].

Constructing fictional scientists and fact-based fictional (genetic) science in writing contemporary science-inspired fiction

This second category examines the portrayal of science and the scientist in fiction writing (again with an emphasis on genetic science where possible). Previous studies into the public's[31] perception of fictional scientists range across different types of media rather than concentrating solely on the written word. Haynes (1994, 2003 and 2014), Kirby (2003), Christopher Frayling (2005), Saris (2006), Russell (2010 and 2014), J.M. van der Laan, (2010), and Jill A. Fisher and Marci D. Cottingham (2016), are key examples of these studies as they

[29] I use a self-styled term 'authentic-world' to represent the contemporary and everyday practices of science, which would be recognisable to scientists, whether in the laboratory or out in the field.
[30] Instances of this can be experienced in the openings to the specific experiment case studies that Collins and Pinch use in *The Golem*. An illustration of their approach is how they introduce the chapter on the search for cold fusion: 'When two chemists…announced…that they had discovered fusion, the controlled power of the hydrogen bomb, in a test tube, they launched the equivalent of a scientific gold rush' (p.57).
[31] It is common in the academic treatment of 'science communication' to intentionally refer to 'the public' in the plural term of 'publics' to signify that the make-up of society is many layered when it comes to a relationship with science. However, in this body of work, the singular term will be used to refer to the general public as one homogenous entity.

consider the stereotypical character and personality of fictional scientists (from across types of media including literature).

Haynes identified seven 'primary stereotypes' (2003, p.244) of scientists who are represented in literature; for my proposed study, the representations offered by the latter two: 'The scientist as adventurer' (2003, p.250), and 'The mad, bad, dangerous scientist' (2003, p.251), would be the most relevant. Of these two (fictional) stereotypical scientists identified by Haynes, perhaps only the 'scientist as adventurer', would offer a suitable and positive way forward for any mainstream science literary fiction, as discussed in the previous chapter. However, none of the fictional scientist stereotypes identified by Haynes may be useful in realising a contemporary body of what Russell refers to as, 'popular, socially realistic [science] literature' (2009, p.35). Though Haynes in an earlier investigation, does allude to some hope in terms of a more engaging scientist stereotype emerging: 'There have been some important studies of idealistic scientists, and it is significant that these characters are evaluated by their authors almost wholly in relation to their contribution to the community, rather in terms of their scientific expertise' (1994, p.294). This correlates somewhat to the approaches I have used in my research study and more precisely, in the writing of the research practice. One key element which is identifiable across the three discrete pieces in the creative work, is that I distinctly use two main protagonists in each of my pieces. In an individual fiction there is a defined role each of these protagonists fulfils, in relation to them either being a scientist or working within the field of science or technology. Haynes identifies a generic counterpoint to the 'mad scientist' (2003, p.251), which is prevalent in fiction from Shelley's writings up to the present-day. Within my creative practice, I represent both Haynes's 'scientist as adventurer' (p.250), who provides a sympathetic version of a scientist (or science), who is fair but flawed and is more concerned with altruism than prestige, and her 'mad, bad, dangerous scientist' (p.251), who is out of control (and adds danger along with the required dramatic tension). These represent the two main protagonists for each of my research practice pieces in the creative work collection. From this perspective, my main (positive) protagonists within individual fictions are engaged in science but not (yet) fully fledged scientists (if you take Rohn's earlier doctoral distinction)[32]. From a creative standpoint I consider that this is these fictional characters' main appeal: they are considered as outsiders and mavericks, and not part of the scientific elite or establishment.

[32] Rohn (2010b) only defined fiction authors as 'scientists' if they had achieved doctoral status. If this were to be accepted, it could mean the same definition being applied to their fictional counterparts.

When scrutinising aspects of scientists communicating (science) in literary fiction, Turney (2009) looks at the notion and approach of 'truthfulness' (with respect to communication of science) in science-as-fiction. He considers whether writers embellish the science (and therefore, the action of scientists) for the sake of the narrative. He also makes some pertinent points on characterisation within science-as-fiction novels:

> 'Novelists need to inhabit the minds of their characters and can help us do the same. This requires an act of imagination... Fiction can thus communicate features of scientific mentalities and milieus, as well as aspects of context and relations between science and society...'
>
> (Turney, 2009, p.170).

In considering the opportunity for authors to place scientist characters in positive situations, Saris in his 2006 article, 'Science through the looking glass of literature', considers that science and scientists presently do not have much to rejoice in through their representations in literature:

> In the century since Lewis Carroll, a whole library of literature has been created representing the role of scientists both in fiction as well as non-fiction... The looking glass has been stained and darkened considerably, leaving a rather gloomy fragmented and essentially distorted picture.
>
> (Saris, 2006, p.1)

He is however more optimistic for both the future of science and literature and added:

> It should make all the difference in our culture, science and literature if, instead of viewing our world as driven towards disorder, its driving force, its arrow of time, is to increase the freedom of movement.
>
> (Saris, 2006, p.1)

This type of freedom suggested by Saris could lead to a wider exploration of science and scientists through popular science-as-fiction, following in the style of detective or mystery fiction.

Mawer in an article for *Nature*, 'Science in Literature' (2005), considers the fictional scientist's role in written fiction. As the author of *Mendel's Dwarf* (1997) in which a geneticist confronts his own chronic condition head-on, Mawer is uniquely placed to contribute to a discussion about where (genetic) science-as-fiction may be heading. He says, with his notion

of the 'supremacy of imagination' (2005, p.298) that fiction can and should be used to deliver the exciting elements of science to the general reader, in a way circumventing the reality and sometime laborious nature of scientific endeavour. Mawer considers that both the concept and actuality of 'science' has always been used as effective descriptors in literature but now, speaking specifically of science-as-fiction he says: '[It is]…only recently that some writers have made the scientific process the very focus of their work' (2005, p.298). In making this point, he draws attention to the validity of science literature as a fair representative of science. Mawer goes on to say: 'It is important not to be misled by the use of the word fiction here. Fiction does not stand as the antithesis to fact. Good fiction points towards truth, which is after all, only where the scientist is trying to go' (2005, p.298). With his 1997 novel *Mendel's Dwarf* and up to his most recent fiction publication *Tightrope* (2015), Mawer highlights pertinent moral and ethical concerns and poses questions of acceptance, rights to decide over life-changing treatments, access to information and ultimately decisions over life itself. From within a narrow focus of genetic science, I support the idea that science–inspired fiction is one suitable platform in which to address a diverse range of contemporary societal issues. These could be ethical ones, such as decisions on what information from an individual's sequenced genome is held in the public domain or moral ones, such as should 'three-parent designer babies' be allowed to be conceived if it means creating an unalterable and unnatural combination of genetic information to be passed onto future generations[33].

In the article, 'Scientists on the set: science consultants and the communication of science in visual fiction' (2003), Kirby sets out to examine the notion of 'scientific accuracy' (p.261) in fiction film. Whilst the material in this study is predominantly concerned with how science consultants and experts were used in the development of 'science as visual fiction', it could equally be applied to 'science as literature fiction'. One of the key areas he focuses his study on is the accuracy of what is shown on screen and the (possible) need to temper this with the need for narrative concerns. He states:

> By questioning the nature of 'fictional accuracy', I demonstrate that the scientific community's focus on 'scientific accuracy' in fiction is flawed. Fictional film naturalizes both 'accurate' and 'inaccurate' science by presenting both as 'natural' via a perceptually realistic framework.
>
> (Kirby, 2003, p.261)

[33] Just one of the issues I raise myself in the work for 'A Common Thread'.

In being concerned with the scientific accuracy of the portrayal of science within (visual) fiction, Kirby does touch upon a pertinent issue that has proved to be a focus of attention and the subject of much debate amongst fiction writers (both screen and literary) and science professionals. Taking the popular science-in-fiction writer Crichton as an example, his use of contemporary, speculative and fantastic science, often mixed all together is served up as a naturalised vision of science and technology which plausibly worked in the narrative worlds in which they were set. For many Crichton's novels these worlds were ones firmly set in a realistic and contemporary naturalistic frame, and so were treated as plausible and recognisable. From the early work such as *The Andromeda Strain* (1969) in which an errant space probe returns to earth carrying a deadly microbe, published during the era of the first manned lunar landing and escalating tension between east and west, to the career-defining *Jurassic Park* published in 1990 and on into the twenty-first century with *State of Fear* in 2004, which considers the environmental threat of deliberate acts of terror perpetrated through means of science and technology. Crichton published very readable stories. His mixture of science fact, pseudo-science and science fantasy with a thriller base, mostly set in a naturalistic environment presented a series of 'What if?' questions. Although they still prove to be hugely entertaining and always thought-provoking, it is sometimes at the expense of the portrayal of contemporary and naturalistic science and scientists.

A consideration of the philosophy of (genetic) science in developing science-inspired fiction

This section focuses on how science-as-fiction is viewed from the context of a philosophical and socio-philosophical perspective. On a fundamental level, science can be considered as a process through which nature is investigated. Scientist and empiricist Lewis Wolpert refers to science as '...the best way to understand the world [to] gain insight into the way all nature works in a causal and mechanistic sense' (1997, p.9). In this sense it is seen as central to the process of understanding science in literature as it helps to explore the process of scientific enquiry which ultimately results in the establishment of accepted scientific practice.

If considered in the field of literature fiction, Wolpert's definition of science (above) presents the reader with something physical or tangible to reflect upon when offered a storyline which deals with science or a resultant technology. From the perspective of a writer, what is harder to establish with a readership is how the laws, theories and principles which seek to explain the natural world are constantly in a state of revision through new

observations and interpretations[34]. Russell questions how it is that these provisional facts or 'matters of facts' (2017, p.2) give rise through interpretation to the laws, theories and principles which seek to explain the natural world, and which are themselves superseded or adapted through new observations and interpretations. (The premise was mentioned earlier with regard to the evolution in the principles of physical sciences from Newton to Einstein.) This is the area of 'Philosophy of Science', which seeks to investigate the robustness of scientific interpretations and provides a framework to test and analyse whether the claims and proposals of scientists stand up to academic and intellectual scrutiny. As an example of how elements from the philosophy of science could be represented in literature, Turney (2009) explains how McEwan in his novel *Enduring Love* (1997), uses aspects of both game theory and evolutionary theory, to describe his characters' actions and their justifications of those actions (in relation to their responses to the pivotal 'balloon' incident). This is an atypical (almost metaphysical) approach as for the majority of pieces of science-as-fiction it is more likely that the processes under consideration would be more concrete especially in the area of genre fiction. As Russell (2017, p.3) indicates, it is the 'shop work' which is dealt with in popular fiction literature as it is more practical to examine through the actions and thoughts of a protagonist how they carry out their primary goal. In most instances, it is more practical to examine how genes are spliced or how genetic material is recovered from a crime-scene sample, through the actions and mechanical processes which can be seen to obtain results directly through those actions.

Russell (2017) raises a further issue that it is often scientists responsible for a particular body of knowledge that are overly critical of fiction which deals with realistic science. Indirectly, an author (writing science-as-fiction) may be overly cautious as they tread a thin line between being plausible and appealing to both a scientific and non-scientific readership. On the one hand, this balancing act demands of scientists that they need to appreciate that the delivery of scientific information in fiction is not as it would be in a scientific textbook or paper. And of general readers, that not all science delivered in this type of writing will be one hundred percent (empirically) accurate. The scientific content should be plausible within the constraints of the fictional world which has been created, even if it is based on a factual, recognisable and realistic one. It is this 'plausibility' which is the main key to the acceptance of both the character of the scientist and the scientific 'facts' or situations which are dealt with in the narrative. If this notion of plausibility breaks down within a story, due either to an aspect of a scientists' character or the scientific information then the illusion of the fiction

[34] As an example, the evolution of the principles of physical sciences from Newton to Einstein to String Theory.

dissolves, and along with it any acceptance or trust (believability) in the science and importantly for here, the 'process of undertaking science'.

Beer in *Darwin's Plots* (1985, p.3) considers that even these elemental or fundamental problems, from whichever era are considered can never be fully appreciated by the proposer of a scientific theory or a solution. She draws on Thomas Kuhn's work, *The Structure of Scientific Revolutions* (1962, p.52), in which he says that ideas often put forward may contain speculations which may not initially be considered a 'scientific fact'. In her Introductory Chapter (p.4) Beer considers that a scientific theory contains much more of relevance than is suspected at the time of its formulation. Beer puts forward an argument concerning narrative structure in relation to the development of new scientific ideas in Darwin's *On The Origin of Species* (1859). She argues that:

> …evolutionary theory had particular implications for narrative and for the composition of fiction. Because of its preoccupation with time and with change, evolutionary theory has inherent affinities with the problems and processes of narrative.
>
> (Beer, 1985, p.7)

It is with this hindsight that Beer seeks to establish clear links between the process of scientific theories and discoveries and the structure of narrative fiction: 'Evolutionary theory is first a form of imaginative history. It cannot be experimentally demonstrated sufficiently in any present moment. So it is closer to narrative than to drama' (p.8). Beer's point is that that the development of scientific reasoning and the focussing of this through the whole concept of evolution, led to a subtle change in the way Victorian novelists such as Eliot and Hardy were to use aspects of (evolutionary-inspired) science in their approach to narrative construction, analogies and metaphors. In science-inspired fiction (such as the work in my collection) the exploration of contemporary science should be used to question the value, morals and ethics of science. Sleigh with her book *Literature and Science* (2011) argues that in fiction the concept we know as 'science' is able to go beyond what is factually correct or can be empirically proven and helps take in the totality of what needs to be discussed in any contemporary discussion of a scientific issue within a society.

A consideration of the sociology of (genetic) science in developing science-inspired fiction

This section considers the position of science (including genetics) in contemporary life and consequently in relatable fictional societies. The focus is on a societal context and contemplates the effectiveness and rigour of social interactions between (genetic) scientists

(and others), and how these affect the resultant outcome of (fictional) scientific endeavours. A consideration of social interactions within the practice of writing science-inspired fiction reveals ways in which fictional scientists work, the personality of the (genetic) scientist and an insight into the experience of undertaking science from a first-hand perspective. All of this is designed to allow readers to connect better with the scientific aspects of (genetic) science-inspired fiction.

According to Jane Gregory and Steve Miller, at the root of sociology of science is the focused viewpoint of the Edinburgh School's 'Strong Program' of the *Sociology and History of Scientific Knowledge* (SSK) (1998, p.64). This perspective holds all forms of knowledge (including that claimed by science and scientists) on an equal footing. The strong program tradition encompasses a variety of approaches as typified in Collins and Pinch's *The Golem* and Bruno Latour's *Science in Action* (1987) in which it sets out to '...critique the public image of science from the standpoint that real science owes a lot (if not all) of its character to the social practice of scientists...' (Gregory and Miller, 1998, p.64). As Gregory and Miller explain, '...[this] symmetry principle allows sociologists, for the purposes of their inquiry to suspend disbelief and to treat all forms of knowledge as valid within the circumstances in which they arose' (pp.64-5). In viewing the role of scientists in this broad way, it gives rise to the suggestion that scientists socially construct science, as opposed to the view staunchly held by opponents of the 'Strong Program' (as represented by scientists such as Wolpert) that knowledge is revealed through the empirical methods of experimentation, observation and application of principles and established (scientific) theories.

Whether there is agreement or not with the concept of the social construction of science, one aspect of the 'Strong Program' which could have implications for the writing and development of science-as-fiction is the methodology of SSK in studying its subjects. According to Steve Fuller and Kirk Junker, the Edinburgh School's approach considers that:

> ...one studies science in the same way that one studies other social phenomena, by going there (where science is being done), looking at how it happens, reporting it and checking to see if what people *say* they do is compatible with what they actually *do*.
>
> (Fuller and Junker, 1998, p.6)

With regards to the development of genetic science-inspired fiction writing and background research, this type of approach would help to engage (non-specialist) authors who wish to write on scientific subjects. It may help to remove some of the illusions that pervade (in

literature and general terms) about scientists being unsocial and solitary. If this engagement were to be more common than it presently is, then the portrayal of scientists might be more accurately presented in popular fiction (or at least the characterisations be more balanced). If readers start to perceive (rightly) that scientists have individual personalities and personal lives as well as professional responsibilities, then popular fiction dealing with the science matters might become more acceptable both in publishing and marketing terms[35].

From an SSK perspective, Collins and Pinch in *The Golem* propose that science only exists in a society and undertakes a useful role in that society, if it can be seen as reasonable and credible by the majority of the populace. In itself this notion of plausibility they say '...is a matter of social context so [it follows that] science is "a social construct"' (Collins and Pinch, 1998, p.18). Collins and Pinch accept that because it would be an impossible task for every scientist to be able to check each fact that they make use of. Science relies then to some extent on trust and the truthfulness of all those involved. They go on to say the first edition of *The Golem* (published in 1993) sparked furious attacks from scientists such as Wolpert who steadfastly refused to accept that SSK be treated within the canon of scientific work.

In a booklet which dealt with the so-called 'Science Wars'[36] in the mid-1990s, Fuller (1998) examines the issues which led up to the public feud (primarily) between natural scientists on one side, and sociologists and philosophers of science on the other. (See earlier points on the rise of SSK and the 'Strong Programme'.) Fuller, in considering the roles of philosophy and sociology in this over-heated debate, sees that amongst the detractors of 'science' were those who shared a common philosophical ground. He refers to these as 'social constructivists' (1998, p.8). Fuller outlines this groupings' perception (of science) as one who views science in the same vein as someone who views the history of the world as 'Western'. And so, it is only open to those parties in the position to write authoritatively about it and therefore 'construct' the end product. Fuller disputes this treatment of science, saying that 'science' is a unique discipline and in the case of the natural sciences, it is all about natural phenomena existing in nature waiting to be uncovered/discovered (and not constructed). Despite this, Fuller regards some of the aspects brought by fields of the philosophy of science and the sociology of science as potentially useful in promoting the debate about 'What science is' and 'The place of science in modern society'. He points out that the scientific community does not readily possess the sorts of skills that (amongst others) philosophers

[35] For example, both McCabe (1999) and Goodman (2009), use fictional but recognisable scientific workplaces as story-world backgrounds, complete with all the tensions and interactions of other, non-scientific workplaces.

[36] See Colin Macilwain's 1997 article, 'Campuses ring to a stormy clash over truth and reason', for additional context.

and sociologists do, in order to engage the wider community in addressing issues which need tackling. Fuller argues:

> Here the historians, philosophers, and sociologists can have a very useful public role in bringing these issues out in a constructive fashion. At the moment the problem is that scientists are very defensive and they see what…philosophers [and sociologists] are doing, as purely negative.
>
> (Fuller and Junker, 1998, p.8)

In direct terms for this study—from the points Fuller identifies—there could also be space for a popular genetic science-inspired fiction to become established, that may help in part to address the issues facing science (and the scientific community) in helping it find a new relationship within a contemporary, ever-changing and ever-sceptical society.

Communicating (genetic) scientific knowledge with the writing of contemporary science-inspired fiction

This section is concerned with how both current and established 'scientific knowledge'[37] and provisional new (cutting-edge) scientific knowledge are communicated within a (genetic) science-inspired fiction. The former is located mostly in published textbooks and the latter exists in the form of written scientific papers (mostly) published in peer-reviewed academic journals (and increasingly in an online capacity). These two repositories (physical and virtual) are where the collection of what is referred to as scientific knowledge is housed and so to enable science to progress (i.e. new hypotheses to be developed and tested), it relies on the peer-to-peer communication of this knowledge between scientists in their role as the 'practitioners' of science. Where scientific knowledge is used within a piece of plausible science-inspired fiction, it is as likely to propose new claims (both fictional and unsubstantiated) as well as to use reputable empirically based ones. In fiction, both are given an equal footing within the design of the story-world. For established scientific knowledge ('science') this seems to go against the whole nature of proving and testing sound and reliable empirical evidence. For convincing science-inspired fiction, in order to develop the story in a credible manner, it is often necessary to go beyond what is wholly accepted as correct or proven. However, with the research practice for my collection a conscious effort is made to stay within the confines of plausibility. Again, this is a subjective claim and one

[37] The term 'scientific knowledge' can be both a catch-all term and a misleading one. It is very subjective and depends at which academic and intellectual level an individual accesses the information required.

which I will look to justify through detailing a selection of the background research undertaken (in Chapter Six.)

As an author of genetic science-inspired fiction, it is important to have defined views on both scientists and science. After all, it is the author who ultimately controls the personalities of the fictional scientists. It is he/she who uses these characters as instruments for what is to be communicated. In the case of my own research practice, this comes through as aspects of a scientist's (or proto-scientist's) character, their ambitions and how they relate to scientific culture (within the context) in which they exist. This latter point, on the cultural significance of science-as-fiction Russell (2010) comments that the authentic world of science has been explored in situ and relationships drawn out between how science and society interact but '...the cultural significance of science in fiction has been relatively neglected'. He concludes that '...readers can learn much about science and its culture from fiction' (p.xiii). This relates directly to the development of the 'outsider' (or proto-scientist) characters which I make use of in the research selection for my creative work. The personalities, ambitions and drive of the characters of Peter ('The Commuter Lab'), Jake ('The Patient Experiment') and Judith ('A Common Thread') are all able to freely observe, react and comment on the culture of (genetic) science because they are on the outside or periphery. They view it with a healthy cynicism which a reader may or may not empathise with. From my own perspective as a reader I enjoy thinking that I am on the edge—on the outside looking in—as this is the place (I feel) to achieve a more-informed view.

When approached as an academic discipline the history of science communication is one fraught with complications. Whether the aim is to address a deficit or just to impart new information as a result of ground-breaking research (as with the developing *Crisper-cas9* gene editing technology), the issue of trust always appears. Recent circumstances surrounding areas in which science and its communication (or lack of) such as GMOs, BSE and MMR[38], have just served to undermine the public's trust in science (and of scientists). As a sociologist of science, Stephen Yearly sees a double meaning in the phrase: 'Trust in science'. He says it can refer both '...to the public's trust in scientific expertise, and to the role of trust within the scientific enterprise itself' (1998, p.3). When scientist characters and science are examined in works of fiction, the issue of trust is never too far away. From the perspective of a reader or a writer, the question of how far a fiction should trust the science and the

[38] Genetically Modified Organisms (crops), *Bovine Spongiform Encephalitis* (in cattle) and Measles, Mumps and Rubella (vaccination), respectively.

scientists it encounters—whether factually based or purely fictional—is a challenge, as it depends on how the author wishes science and scientists to be represented.

Closing Chapter Statement

The impetus with this second chapter has been to illustrate, through contextualization, the areas that I propose have an impact on designing and writing a collection of science-inspired fiction. The comprehensive approach employed illustrates the range of topics that have been closely examined. These are considered areas which offer significant indicators in helping to deliver science-inspired fiction both for this study and for future (publication) opportunities. In Chapter Three I will discuss the specific PaR methodology that influenced my approach across the practice and critical elements of this investigation.

CHAPTER THREE
Thoughts and applications on creative writing as practice-based research (referred to as Practice-as-Research or PaR)

Using Nelson's 'Models for "Practice as Research"' (Fig. 1: 2010 and Fig. 2: 2013)[39] as a starting point, this chapter establishes how 'practice-based writing as research' is appropriate in demonstrating the development and dissemination of new knowledge in creative writing practice.

At the core of this study, I embarked on the research, development and writing of three pieces of creative practice: 'The Commuter Lab'; 'The Patient Experiment', and 'A Common Thread'. These form the original fiction material for my research-as-practice thesis contained within the collection. The pieces are available in the main body and are also outlined in Chapter Six - 'Creative practice: process, contexts and influences'. I will illustrate that within these pieces of creative writing practice elements of research-related theory overlap with the make-up, undertaking and development of my practice, to show the presence of praxis[40] within an arts context, and more specifically, a creative writing one.

For this applied discussion on creative writing as PaR[41], it is intended to begin with the categorisation used by Nelson within his 2010 and 2013 dynamic 'Models' (see Fig. 1 and Fig. 2) of 'Know-how', 'Know-what' and 'Know-that' to help illustrate possible routes and interactions for both designing—and appreciating—the ideas of PaR, with the emphasis on creative writing practice. Consideration can be given to the result of creative writing practice—and the contextual work which constitutes that practice from subject and content research, practical knowledge, technical knowledge and creative imagination—as the production of 'new' or 'original' knowledge. In an academic research environment, purposely in relation to the structure of practice-based PhD research and awards in the performing arts, Nelson and Stuart Andrews (2003) consider that:

> ...research questions in the performing arts can be rigorously worked through in a range of practices (of which writing is only one) to

[39] Nelson uses a revised version of his 2010 'Dynamic Model' as published in Fig. 2.2 (2013, p.37). See Fig. 1 and Fig. 2.
[40] Nelson (2013) explains the term *praxis* as: '…theory imbricated within practice…or what some call intelligent practice or material thinking' (p.5).
[41] For this research study, PaR incorporates both 'Practice-Based Research' (P-BR) and 'Practice-Led Research' (P-LR) under this umbrella term.

> produce new knowledge or substantial new insights equivalent to the requirements of PhDs as traditionally established.
>
> (Nelson and Andrews, 2003, p.1)

Although this joint report considers specifically the 'performing arts' their experiences and findings may be applied across other practical arts subjects: 'The findings of this investigation having been provisionally drawn up, it is hoped to cross-refer to other related sectors involved in arts or media practices' (2003, p.1). In relation to the practice of creative writing fiction—short stories, novelettes, novellas and novels—there is a clear distinction between the research practice of performing arts and the research practice of writing fiction, but there are points at which they intersect and parallels can be drawn both from the experiences of creative writing as an expressive art form and the closeness of fiction to related forms of craft writing such as stage writing, sketch writing and monologues, to name but a few. However, although there are technical and creative similarities in areas such as: narrative, story, plotting, visualisation, character development, three-act structure and so on, to substantiate the use of Nelson and Andrew's findings to my creative practice research, I examine more explicitly the debates and the contexts of creative writing practice-based research. This will then link this back to an analysis of my own practice developed from the framework offered by Nelson's models for PaR (see Fig. 1 and Fig. 2) in a context of both creative writing and arts practice research.

The publication of the *Creative Writing Research Benchmark Statement* (Neale/NAWE, 2018) by the National Association of Writers in Education (NAWE) Higher Education Committee[42], looks to provide 'Creative Writing Research' with a definitive and clear presence in the sphere of academic postgraduate, doctoral and post-doctoral research. The 2018 statement sets out a number of categories and topics that consider areas such as: what should be considered as creative writing research; the future development of the subject area, and a focus on the structure of creative writing practice as the predominant method of creative writing research degrees. The benchmark statement seeks to examine the generation of both knowledge as an outcome but also as an inherent product of engaging in a practice enquiry, as it states, 'Creative Writing research assumes that process, practice, product and critical reflection each generate knowledge, separately but also in combination' (2018, Introduction).

[42] An update to the 2008 combined NAWE benchmark statement.

In the initial category of 'Defining Principles', NAWE looks to bring a definitive focus on how both the creative process and creative practice are dealt with in creative writing research. In the first of these principles it says:

> Creative practice research can include a range of methods, approaches and styles, including those variously labelled as practice-led research, research-led practice, practice-based research and practice-as-research. The commonality in all types of creative practice research is that the researcher produces a creative work. The process of artistic practice and its resulting output are perceived as contributions to knowledge.
>
> (Neale/NAWE, 2018, 1.1)

Thought is given here—at the beginning of the benchmark statement—to an area or outcome of research that is regarded a cause of concern: the question of how 'knowledge' in academic terms is delivered from the practice (and process) of creative writing. In my own practice research and critical discourse, I extrapolate a direct, traditional notion of knowledge and it is only through the critical reflection on my practice, that I am able to draw out definitive contributions to creative writing practice, science-as-fiction and science communication. An example of this contribution is in the work presented in the findings of the comparative analysis between Barrett's, 'Birds With No Feet' and my own piece, 'The Patient Experiment'. This concern of successfully conveying the merit of a creative writing practice project and associated critical discourse contained in a PhD study, is addressed in a chapter on 'Poetics and Creative Writing Research' by Kim Lasky within the book, *Research Methods in Creative Writing* (Kroll and Harper, 2013). Lasky states, 'One of the key challenges of creative writing research lies in successfully articulating the relationship between the creative work and the critical context, thinking, and outcomes associated with its production' (2013, p.14). Lasky discusses that in creative writing, the notion of 'poetics'[43] can help with those questions a critical discourse is often concerned with. The author considers the original Aristotelian concept of poetics and how it was later applied to poetry-based practice and suggests that the current usage of poetics in regard to contemporary creative writing practice '…refers to the means by which writers across a range of genres formulate and discuss a critical attitude to their own work' (p.14). According to Lasky, this helps the writer-researcher[44] '…gain perspective on the interrelated aspects of practice and theory, and the

[43] In the wider historical scope of literature, Lasky states that poetics refers to the '…study of principles and forms of literary composition' (2013, p.14).

[44] Writer-researcher is a term I was first introduced to in Jen Webb's book: *Researching Creative Writing* (2015). She uses it describe, '…creative writers who want to conduct research in or through their creative practice - what we might call writer-researchers' (2015, p.11).

critical and creative activities involved in the act of writing, helping them to express the knowledge gained through practice-led research' (p.14). This proposal, to help writer-researchers prepare for and approach a critical discourse through reflection, and by drawing out the influences on the creative work and those on the writer's position—including drafting and revision stages and the stimuli affecting these—offers a viable method of comprehending and expressing the processes inherent during the enterprise of creative writing practice. One proviso with this approach—based on my own experience of undertaking a similar critical discourse—is that this element would need to be supported by additional concrete elements that help to situate the overall project of practice and discourse within a contextual framework. For my own, it is one of science-as-fiction in speculative contemporary fiction and science communication.

In a following section of the chapter 'Poetics and Creative Writing Research', Lasky investigates this concept of poetics through a brief analysis of three notable writers (and associated works): Henry James, John Fowles and Doris Lessing. The subsequent findings offer an insight into how a writer-researcher might approach a critical discourse of their own work. In summary, Lasky highlights a long list of what she terms the:

> …various elements feeding into the writing process, which span false divides often posited between public/personal, emotional/intellectual and creative/critical. Developing a poetics, then, means drawing reflexively on a range of inputs.
>
> (Lasky, 2013, p.20)

The author expands on her range on 'inputs' and says that those engaged in a critical discourse of this kind should consider poetics as an approach to examining their critical work in direct relation to the practice undertaken. Lasky produces a long list of these 'inputs'. A small sample is reproduced for context: 'Writing practice – including exercises, first drafts, rewrites'; 'The influence of other writers, contemporary and historical, working in the genre and beyond'; 'Influences drawn from other disciplines, such as scientific theories or philosophical thinking'; 'Challenging conventions', and 'Rethinking and rewriting' (pp.20-1). When the potential development topics to employ in writing a critical discourse are clearly displayed and total nearly twenty, the writer-researcher is able to draw on a number of suitable categories through which to examine and investigate their creative writing practice.

The 2018 *Creative Writing Research Benchmark Statement* offers a comprehensive declaration of what is considered research in the area of creative writing practice. It covers a

range of areas such as the 'Scope of Creative Writing Research' to 'Assessment of Creative Writing Research', in an inclusive deliberation on how creative writing research should be engaged with in academia. In relation to how this benchmark statement would affect a research study broadly similar to my own—a PaR study based on the writing of factually based fiction situated within an overall context of science—there is a suggested requirement within the area of 'Research Degrees in Creative Writing', that offers a useful consideration in the expectation/assessment of my completed study. This point states:

> Where a critical or reflective commentary in combination with the creative submission is required, this should demonstrate consideration of, and or response to, the various contexts in which the work was generated. These contexts can be, for instance, historical, theoretical, cultural, formal or aesthetic, and such considerations should be viewed as part (but not all) of the project's contribution to knowledge.
>
> (Neale/NAWE, 2018, 4.6)

The rationale (critical work) that accompanies my creative practice content is designed to examine the creative writing—presented as my collection—against a context of science and science communication as its main critical component.

To complete this short reflection on a number of the debates and contexts of creative writing practice-based research, I will also consider some of the points raised by Jen Webb in her book: *Researching Creative Writing* (2015). Webb draws on the visual arts and specifically on Frayling's prominent research paper for The Royal College of Art (1993/4), to draw parallels with how research in art and design forms and informs practice, and how this can relate directly to research practice in creative writing. Frayling considered what practitioners did in relation to what they termed research. He categorised it in the following three ways: 'Research into art and design'; 'Research through art and design', and 'Research for art and design' (1993/4, p.5). Frayling said that the first category of 'into' was predominantly concerned with researching into historical aspects and the wider socio-political influences. The second, 'through', is what would normally be perceived as practice research (P-L, PaR and P-B) typically undertaken as an agreed project to be realised—as an artefact—and then reported upon. And thirdly, 'for', which is akin to the accumulation and sorting of background research as a method of validation (perhaps for a separate artefact). Frayling's final comments for Art and Design (in 1993)—as that area was accepting the onset of research practice doctorates—certainly resonate with the current state of play (in the UK but

perhaps not Australia, New Zealand or the US) in regards to the acceptance of creative writing practice doctorates: '…it seems to me that we have a fascinating dilemma on our hands… Once we get used to the idea that we don't need to be scared of "research" – or in some way protected from it – the debate can really begin' (p.5).

Webb takes up Frayling's three precepts and applies them to practice research in creative writing. 'Research into…', she says, offers a writer-researcher the opportunity to undertake analysis into historical or wider areas such as analysis of an individual or a political movement in order to engage with an in-depth understanding, and to bring this into a novel or piece of creative writing. With 'Research through…', a writer-researcher would undertake a specific project to produce a piece of creative writing (or collection) that would be subject to a critical discourse based on '…reflecting consciously on an element of technical expertise…[that]…can be drawn on by other creative writers, to develop their understanding of how to make a literary artefact…' (2015, p.13-4). Finally, with 'Research for…', Webb says that this research practice is common to all creative writers, as the need to check facts and other material that a reader expects to be correct is a standard procedure. Although this is not 'Research' in a conventional academic sense, it is often referred to by a general term of 'background research'. Although Frayling's original work relates specifically to Art and Design, it can be seen through Webb's analysis that creative writing practice as research does fit very comfortably into the classifications Frayling identified.

To put my own practice research into the context of Frayling/Webb, the majority of my work would fall into the second 'through' category, with inevitably some coming under the background research and fact-checking of the third 'for' category. I would have a substantial amount of research classified under the first category of 'into', due to my practice being infused with scientific research elements (in 'The Patient Experiment'), historical aspects (in 'A Common Thread') and purposefully, scientific procedural features in all three of the practice research pieces.

Robin Nelson's Models for 'Practice as Research'

Nelson R. (2010): A Revision to the Original Dynamic Model for 'Practice as Research' (PaR)

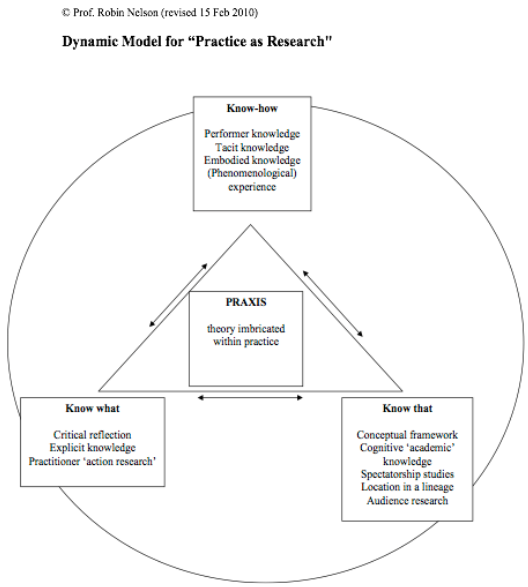

Fig. 1: Dynamic Model for PaR (Nelson, 2010).
(This is a revised diagram following the original published in: Nelson (2006) 'Practice-as-Research and the Problem of Knowledge' (p.114). As cited in a presentation by Christopher Baugh (2012) at University of Winchester.)

Nelson R. (2013): Modes of Knowing: Multi-mode Epistemological Model for 'Practice as Research' (PaR)

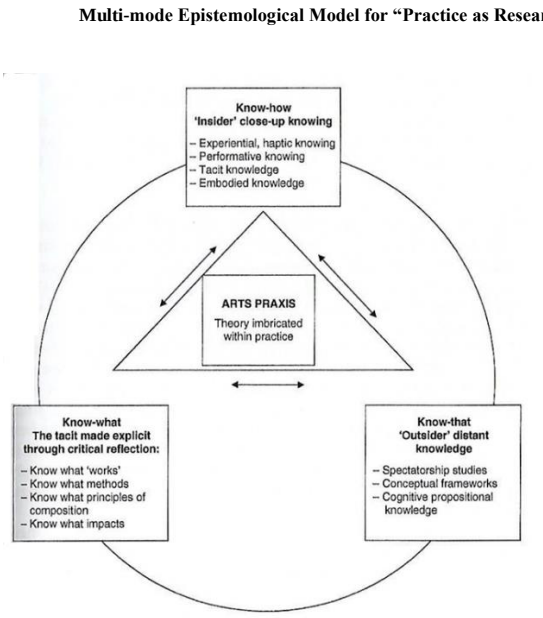

Fig. 2: Modes of Knowing: Multi-mode Epistemological Model for PaR (Nelson, 2013, p.37).

Nelson says that for a practical (field of study) in which theory is present but which may or may not be overt, evidence of PaR can be expressed as 'Modes of Knowing' (2013, Fig. 2, p.37) centred around a core of 'practice' (referred to as *praxis*), in which academic theory is part of, and arranged within, the (arts) practice. This observation is the lynchpin of Nelson's model: that praxis is at once at the core but also acts as the conduit for all interactions within the umbrella term 'Practice as Research' (including Practice-Based Research, P-BR and Practice-Led Research, P-LR).

The three distinct 'Modes of Knowledge': 'Know-how', 'Know-what' and 'Know-that' (Fig. 2) which produce evidence of PaR, interact with one another to give this PaR model its dynamic nature. I apply these modes (where relevant) to my research practice study to illustrate the viability of its approach, as an example of 'Practice-as-Research'.

Investigating my practice-based research (including the creative work) with Nelson's models for illustrating the dynamic nature of 'Practice as Research' (PaR).

A. 'Know-how'[45] ('"Insider" close up-knowing'):

'Performative knowing'. I have brought to this study an understanding of both the creative writing techniques of how and what I would like to create with my practice, and also what I would hope to effectively communicate with the knowledge brought from my experience/study and understanding of (genetic) science.

'Tacit knowledge and understanding'. From a personal and professional background, I have an interest in and an understanding of aspects of science, technology, media, creativity, writing, critical enquiry and communication, all of which are on an inherent level. This is often implied in my work and occasionally enters into my practice. In my writing for example, I have tended to take for granted that it is a common knowledge how a laboratory is set up and what (generally) happens there because of my own professional experiences and education but I know this is not the case. So, I try to portray laboratory processes for a general audience although this can in turn have a negative effect for both a specialised (and a general) audience.

'Experiential knowing'. My creative expression and endeavour is an on-going process learning through experience, specifically being able to reflect on the undertaking of practice. This enables me to gain a knowledge and understanding to inform the exploration of

[45] The relevant cited material in single inverted commas (' ') for the following three sections (A-C) refer to Nelson, Fig. 1: 2010 and Fig. 2: 2013.

scientific, ethical and moral perspectives, issues and discussions relating to representations of genetic science in a twenty-first century context.

B. **'Know-what'** ('Tacit made explicit through critical reflection'):

'Critical reflection'. During the final stages of the study, there are two areas where I have used aspects of critical reflection to generate knowledge and understanding. The first is through a critical analysis (of practice) of a fiction collection (Barrett's *Ship Fever*) and subsequently using this knowledge, a similar comparative analysis of one original piece ('The Patient Experiment') and one professionally published piece (Barrett's 'Birds With No Feet'). A second critical activity has been undertaken through the (continued) re-drafting and re-writing of the practice pieces submitted as my final creative work collection.

'Explicit knowledge'. Due to the nature of my research practice, I have used aspects of explicit knowledge for two different purposes. The first has been to use found material from a variety of published sources as inspiration, development material and factual material all to help build up credible scenarios and characters. Secondly, through re-working factual material and incorporating it into fictional scenarios and situations, the 'end-product' of credible, speculative fiction will bring a new perspective and/or understanding into the areas which have been imagined and written about. In this way, it is considered that these 'explorations' will add to aspects of knowledge and understanding in the academic and scholarly areas in which my research practice is situated.

C. **'Know-that'** ('"Outsider" distant knowledge'):

In a report undertaken by Chris Rust *et al.* (2007) for the Arts and Humanities Research Council (AHRC) into practice-led research in art, design and architecture[46], one of the conclusions of the review was that: '…conventional ideas of contribution to knowledge or understanding may not be serving us[47] well' (p.5). With this in mind and the further questions raised in the report about certain incompatibilities between ideas and channels of the transfer of knowledge and understanding as research validators and outcomes, the difficulties of fitting the outcomes from a research practice study into accepted frameworks so they can be considered as 'research', could be a little problematic. However, considering research practice outcomes as artefacts and/or objects to experience and/or examine that both explore and encapsulate the ideas, processes and knowledge which has gone into their

[46] Rust, C., Mottram, J. and Till, J. (2007) AHRC Research Review Report: Practice-Led Research in Art, Design and Architecture.

[47] 'us' can be read as a term for all those interested or engaged in practice-led/-based/-as-research across ADA (Art, Design and Architecture) and the wider Arts community.

creation, and drawing these elements into 'new' or unique pieces of work that contribute knowledge and understanding, should be considered a valid research outcome. Some of the same issues—pertinent to creative writing practice research—are raised and commented upon earlier in this chapter through using material from Frayling, Lasky and Webb, and can be found in the recommendations of the NAWE *Benchmark Statement*.

The review undertaken by Rust *et al.* (2007) proposes that the object of the practice is often subservient to the knowledge gained from undertaking the research activity. This is from an idea first proposed by Stephen Scrivener (2000) in his paper, 'Reflection in and on Action and Practice in Creative-Production Doctorial Projects in Art and Design':

> A more purposeful approach, clearly making practice subservient to research, proposes that any definition of practice-led research should concentrate on how issues, concerns and interests can be examined and brought out by production of an artefact.
>
> (Scrivener, 2000, p.12)

I regard practice as offering the opportunity for research contributions (to knowledge and understanding) generated both through engaging in a creative endeavour—and so advancing from the knowledge gained through undertaking the practice—and from a separate but related knowledge found in the completed artefact (collection). I contend that both hold an equal value in research terms albeit addressing different aspects. In my own PaR the latter here informs the former in both a dynamic and critical-creative approach. A simplified example can be illustrated as such: As my creative practice (writing) progresses, my technique improves alongside my experience in incorporating the desired content into my writing, which is helped by an enriched technique. This enhances the development of the characters—who carry the story—and the narrative. The understanding of this dynamic enables a greater appreciation of how the creative informs the critical and vice versa.

With the help of the ideas put forward by Nelson, Boulter, Webb, Lasky, Frayling and others (in this varied field of arts practice), it is now possible to show how a critical-creative approach can be used as a solid base for examining research practice in creative writing.

Closing Chapter Statement

Through an understanding of Lasky's application of 'poetics', Webb's writer-researcher focussed adaptation of Frayling's three modes of practice research and Nelson's 'Modes of Knowledge', and through the subsequent application of a PaR methodology, I was able to investigate both the nature of my practice and the reflective work in the rationale from a

critically informed position. From this I established operational foundations for work influenced by this theory and these are explored in the subsequent chapters from a research-related critical discourse perspective.

CHAPTER FOUR
Designing science-as-fiction: developing creative work as research practice

The creative work collected for this submission consists of three individual creative writing pieces that share a common theme of genetic science[48]. Each fiction takes aspects of current and contemporary empirical genetic science as their background and inspiration. These pieces—two novelettes and one novella—total the equivalent of a short novel in their edited and completed collection form. The research practice focuses on presenting creative, imaginative and plausible fiction that highlights a range of potential effects on and consequences for twenty-first century science, as it embarks on human-based, empirical genetic and synthetic biological research[49].

The three pieces that constitute my final collection are outlined below, each presented as a concise synopsis. These fictions are primarily character-centred, situated in a recognisable contemporary Western UK setting and work within science, medical and genetic science environments.

Synopses

'The Commuter Lab': An under-employed science graduate finds himself caught up in an illegal, real-world genetic experiment trapped between a covert governmental organisation and a fringe group of genome hackers. (CWP1)[50] (Novelette)[51]

'The Patient Experiment': A disillusioned junior doctor tries to escape an emotionally driven episode which has blighted his fledgling career as he seeks solace and purpose as a psychology researcher in a medical care centre, only to discover that perhaps some mistakes are destined to be repeated. (CWP2) (Novelette)

'A Common Thread': A seasoned anthropological researcher is seconded to a micro-biological project in unusual circumstances and finds that her analytical skills are not the only thing the experimental project requires of her. (CWP3) (Novella)

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[48] Although genetic science is the main link between the individual pieces, each fiction exists in a world of science and technology.
[49] Schmidt *et al.* (2013, p.1), refer to a similar approach to creative work as 'Diegetic Prototyping'.
[50] As previously indicated, the CWP refers to the numerical nomination given to each creative piece.
[51] As categorised using Tuttle's definitions – see Chapter One for specific details.

Science-as-fiction Formative Considerations

Science-as-fiction Approach

In developing approaches both to the fiction and the science-inspired creative research and development for my practice, I have appropriated the culture of science from within the biological, genetic and medical sciences. The aim of this approach is three-fold: to help infuse my pieces with plausible characters and scenarios; to offer a credible, contemporary background for the science and fiction to co-exist in, and to provide a platform for debate on the position of the issues of genetic science. I do this from the perspective of a non-scientist but with an interest in how and where genetic science (and resultant technologies) will impact on contemporary life. (As I have stated, the works in my collection are all character-centred. The discoveries and revelations concerning (genetic) science focus on how these characters interact with this knowledge.)

Science Subject Research

Detailed background research is a vital part of the creative writing process for my study. In-depth research has been carried out into ensuring that the science and genetic science concepts that the story and structural mechanics rely upon are both plausible and seen to be plausible.

Alongside this background detail, accuracy of the scientific ideas is checked and in the case of 'speculation'—refer to Atwood's earlier comments discussed in Chapter One on the use of this term—this is established that it is as accurate as it can be. These considerations are crucial to what I have achieved with the creative work as I require the fictions to work at a storytelling structural level and, in parallel, on a plausibly believable and meaningful level too.

In considering my initial approach to the creative practice, I wanted to provide a reader with credible and accurate (genetic) science so the pieces (and their scientific and non-scientific characters alike) are relevant to issues about the role of genetic science in contemporary life.

Narrative Choices and Approaches

After considering the style (science-as-fiction) and type (speculative) of the work I wished to write, I looked to balance the demands of writing contemporary fiction with those of delivering plausible science-inspired tales. I did have a number of factually based ideas and outline sketches, so I required a strategy for choosing the most appropriate approach or

approaches to narrative structure that would best serve my (proposed collection) of speculative science-as-fiction. To this end, I developed a framework to consider how science and scientific ideas (and by extension, science-affiliated characters) are utilised in fiction, and so would help me choose an appropriate approach to developing balanced narrative choices in each piece.

This framework is delivered as a series of questions—which could be directed at reading/analysing external work and, as in this research practice, pre-writing enquiries—that in answering, offers the chance to decide on (or examine) elements specifically pertinent to designing a science-as-fiction narrative, and are as follows:

Is the science (information) used to solve a particular problem?

Is the science utilised as a carrier mechanism for the narrative?

Is the science simplified (too much)?

Is the science explained (sufficiently)?

Why should the science be explained?

Is the purpose of using the science to entertain? If so, is this different from a narrative where the purpose is to inform and push debate?

Will there be the need for exposition and explanatory text in the narrative being written?

Is it possible to integrate explanatory elements into the narrative, if possible, without the reader realising it? Is this the ultimate goal for science-as-fiction?

What do I wish to communicate? With narrative, characters, their situations and the science-inspired ideas and concerns?

Is the science used with conviction or merely as a narrative prop (or device) in the structure?

In science-as-fiction, are professional scientists seen as sympathetic characters?

This context enabled me to think about a science-as-fiction narrative as the exploration of an idea through science and how its dramatic nature comes directly from that exploration.

While the above framework is an example of one of the methods used for interrogating my structural approach to writing the PaR collection, the outcomes are illustrated below and in Chapters Five and Six through a variety of material that reflect upon the creative decisions made in the course of this practice-based study.

Developing Fictional Characters

Once I had the basic premise for each fiction and I knew the general science ideas I would be dealing with, the characters were able to evolve within their respective story-worlds. This character growth and development is what drives and progresses the individual storylines. Whilst aspects of genetic science are the core themes across the collection, it is the main characters that these pieces are built around and their reactive solutions to what happens to them. This is the overriding creative concern for the collection. It is through the experiences of these characters that the ideas of 'genetic science', and how their impact on a contemporary society may be felt, is what shows the underlying strength of this fiction collection.

Not all of the main and secondary characters who feature in the creative work collection are professional scientists in classic research terms (in that they do not possess doctorates or are tenured doctors or professors). Populating the individual fictions are a broad collection of science professionals, medical specialists, science journalists, technologists, engineers, 'outsider' scientists or science-educated amateurs. The character-types employed, and the specific structural approaches chosen, are to help in addressing how the issues of exposition and scientific ideas are sometimes handled in science-related fiction. In part, these issues are centred on the way factual-based information and ideas are delivered in a fiction.

In using my specific approach of the 'outsiders looking in', it is in no way to marginalise or to undermine the role of the research scientist. It is purely a structural decision that in the majority of cases the character of the research scientist is there as a plot driver and as a secondary or subsidiary character. Apart from 'The Patient Experiment' with the character of Dr. Jake Balfe[52], these fictional research scientist character-stereotypes do not command the main story-centred role.

The key pivotal characters (in my practice) are positioned so that part of their role is to have a need to learn (or discover) material about a particular aspect of genetic science, or the application of it as a technology or engineering dilemma. It is vital that these main characters have a believable and understandable reason why they are within the sphere of professional research scientists and their empirical environs, to maintain the logic and authenticity of each story. In 'The Commuter Lab' the main character, Peter McAvoy, has an academic background in the biological sciences up to MSc level but is not employed in any

[52] And even here although Dr. Balfe is a medical professional he is not a research scientist but an assistant.

related field. Crucially he is a long-time friend of a so-called 'garage genome-hacker'[53] known as TT (an 'outsider' scientist). This brings him into direct contact with a professional-level genetic science environment he would not otherwise be part of. This approach to the main character as an informed and intelligent participant offers the opportunity for using different styles in disseminating scientific information in ways other than an obvious or didactic fashion.

In structural terms, I have set up my main characters to eventually rely on scientific knowledge to release the dramatic nature of the pieces. I am careful that this reliance does not make the main characters subservient to the nature of the (genetic) science involved, as they need to act on their humanity and emotion to achieve their aims. In 'A Common Thread' the main character of Judith Catchpole—a seconded research assistant from the university's Anthropology department—feels bound by curiosity and a pride in her work but is also economically dependent on the position she finds herself. She has no choice but to initially go along with Professor Charles's seemingly bizarre experimental research. Judith later realises that when moral and ethical lines are crossed, she decides to take matters into her own hands and liberates the subject of the research, placing it/him into a less exploitative environment.

Along with unravelling the threads of the genetic science involved, my fictions are structured so the main and secondary characters pick up on any wider societal implications (and potential near-future implications) as a result of the use of science and genetic science within the storylines. In 'The Commuter Lab' the character of Amy Avelyne, a qualified research scientist who works instead as the security manager for the shadowy Lizard Street research facility is in a unique position. Amy sits at the convergence of the information as it passes between the clandestine research base, the 'genome hackers' (Peter and TT) and an international independent body set up to monitor the development and results of genome research across the globe (known as 'The Network'). Hers is the only overview of the whole situation. Amy is privy to all the inter-connecting information and can see the fate, not only of Peter and TT but also the potential wider consequences of the genetic research being conducted at the Lizard Street Centre—also referred to as the Centre—under Professor Randall's guidance. She chooses to sacrifice the two 'laboratory animals' (Peter and TT) to keep the anonymity of the research intact, whatever the cost. Similarly, in 'A Common Thread', the character of Judith experiences a glimpse of the near-future close-up and it

[53] The term 'garage genome hacker' is taken from a *New Scientist* Technology article by McKenna, (2009, p.20), to describe the phenomenon of engineering DNA using inexpensive and uncomplicated synthetic biology techniques.

proves too close to home in Professor Charles's research programme. Judith decides that she is in a better, more balanced state of mind to look after the professor's experimental research programme. She is motivated by a sense of altruism but is also driven by self-preservation for her own genetic material, and so Judith offers the chance for the experimentation to be run under more moral boundaries. On reflection I find it interesting that despite glimpses of what the respective experimentations and research are capable of, neither character chooses to destroy the research but attempts to 'control' it under skewed versions of moral and ethical considerations[54].

In following this approach, (genetic) science has been used to infuse characters (and storylines) with the purpose to entertain, explore and communicate. This can be seen in the construction of the narratives for my creative practice, where a decision was consciously made early on to employ a structure that would utilise a character-led narrative fiction approach, initially representative of scientific issues which could then be developed into a 'human' story—and consequently have the potential to become one filled with emotion, life experiences and relationships—instead of one (directly) about science.

From a comparative/contextual perspective, this approach seems to be the strength of Barrett's *Ship Fever* collection which contains fictions that deal with professional and personal relationships. This is illustrated with a piece such as 'Birds With No Feet' whose proto-scientist characters are representative of scientific issues together with being characters in their own right.

Creative Writing as Practice-as-Research: Beginnings

As the focus of my creative writing research practice is concerned with the exploration of contemporary ideas inspired by science fact and informed speculation, I am perpetually interested in news of scientific and technological ideas and developments. I collect 'cuttings' from scientific papers, academic journals, newspapers, radio programmes and, latterly, online media. In the margins I annotate with a 'What if?' speculation for a fiction storyline idea based on an extrapolation of the science or the potential effects of the science concerned. This is normally stored away for a later purpose. I have used these 'seed ideas' as

[54] What I am trying to indicate with this observation (as a writer) is that both Amy's (in 'The Commuter Lab') and Judith's (in 'A Common Thread') actions were characteristic of their individual traits, and that these actions were in their nature, so it is highly probable and plausible that this is what they planned (and did do, outside of and beyond the scope of the current storylines).

the basis for prose poetry, short and feature-length scripts and now increasingly, short and longer-form fiction.

When this interest eventually became the subject of formal research study, I set out to bring a more ordered approach to how I choose and develop potential ideas, from the initial seed stages up to preparing a first draft. Although on reflection this gives the impression of a somewhat clinical scientific approach to the creative process in helping to craft pieces of imaginative work, this is not the case. I set about my doctoral study with an informed methodical approach. I settled on examining each seed idea to see if it was viable using specific 'strands' or lines of enquiry. These helped me to decide which ideas I followed up on as my research practice.

The first of these strands is concerned with where my personal interests lie. The second allows me to consider which scientific areas are likely to have most impact on people's lives over a very short space of (near-future) time. The next explains whether the material provides enough scope for delivering an entertaining, readable and imaginative storyline. And finally, I consider which of the ideas drawn from current-science or predictive science and technology is plausible enough to be approached for research practice as fiction.

Although each piece I chose as practice research for inclusion in my collection of creative work was developed individually and in a linear fashion, the seed ideas of the two novelettes ('The Commuter Lab' and 'The Patient Experiment') and the novella ('A Common Thread') were developed at one initial stage early on in the research process. The resulting staggered approach to the writing of the individual drafts has been beneficial. As the field of genetic science is currently moving at an incredible rate, I have been able to incorporate concepts and areas into the final stages of my creative research work that push up much further against the boundaries of plausible science and add to the contemporary nature of the research in my collection.

Illustrating a balance of the aims of science communication and the construction of fiction through my PaR collection

Once I moved on from developing the basic premise, the main characters and narrative approach for each piece, I was able to consider how each fiction could achieve a balance between delivering the elements of (genetic) science communication and constructing a piece of fiction that would be both publishable and a reader would want to engage with. Being at once plausible and readable always occupied my thinking and influenced my approach to the research practice, so as I developed the pieces into character profiles and longer treatments, this aspect evolved along with the narratives. To give an illustration of

how this balance occupied the initial drafts of each piece, I present below a selection of my early (original) work, that shows how managing—and reflecting upon—this equilibrium between science communication and the construction of fiction was always at the forefront of my practice design and thinking.

'The Commuter Lab' (A novelette)

Central Character: Peter McAvoy.

Character Development: Peter was a promising bio-engineering postgraduate student but partly through a lack of opportunities and motivation, he finds himself as a charity-mugger ('chugger'), while waiting for a suitable scientific job to arise. Being part of the crowd is Peter's normal behaviour, but a mischievous streak often gets him into situations he finds uncomfortable, which is exactly where his behaviour lands him at the start of the narrative.

Narrative Outline and Contextual Commentary: Set against a living, evolving cityscape, a covert governmental team set about to undertake (illegal) biological experiments on a section of the population: the commuter. The experiments are almost undetectable, as they make use of common microbes and spores, with only a slight adjustment to their genetic make-up. Due to Peter's intervention, a sample of the released/captured genetically altered material is acquired and analysed through a genome geo-mapping process that reveals its true nature and potential/intended purpose. Despite the efforts of the covert governmental organisation to retrieve the sample, Peter and his genome-hacker companion are lethally exposed to a concentrated dose of the genetically altered spores and are left to fend for themselves as the covert group disappears into the recesses of Whitehall.

The focus with 'The Commuter Lab' is on the character of Peter and how he becomes unwittingly caught up in something because of his prior knowledge and scientific training. The narrative predominantly revolves around his efforts to both get answers and stay out of trouble. There is an additional strand to the story, and this involves the personnel of the covert governmental group and the power struggles within this, brought to the fore by the incident of the stolen sample. The fiction is structured so the two narrative strands work with each other to conceal/reveal information, both set against a scientific and technological backdrop.

'The Patient Experiment' (A novelette)

Central Character: Dr. Jake Balfe (MD).

Character Development: Jake has been placed on extended leave from his medical position at a prestigious hospital. If it wasn't for his promise as a future consultant and his family ties,

he was sure he would have been quietly dismissed (and perhaps criminal charges brought), as a result of becoming too emotionally attached to a terminally ill patient. Thankful for this second-chance, Jake accepts a position as a junior psychology researcher with some light medical care duties, as a self-proscribed course of rehabilitation. He looks forward to a period of self-reflection and solitude, as he thinks he will have time enough to address both his guilt and future plans.

Narrative Outline and Contextual Commentary: Unable to cope with a future in medicine, due to emotional stress, a young doctor seeks a sanctuary in an area of (mostly) non-clinical medicine, as a psychology researcher at a private institution. Light clinical duties are involved and are part of the deal he has been offered to move sideways without losing his medical status. Jake's sole charge is a patient enigmatically known as TP, whom he meets unawares on his first day in the new post. Jake researches TP's condition and mental state, and eventually concludes that TP's future should be left to play out to its final conclusion without any further medical intervention. This may or may not be what everyone else wants him to do. Jake's decision is as much for his benefit as that of his patient's. Along the way, Jake discovers a spin-off treatment pioneered through TP's condition. This sickens him and helps decide both his own and TP's fate.

At the heart of this story are two human conditions that become inextricably linked as the narrative draws to a close. Both Jake and TP have secrets which they hope to extinguish: one has too much emotional attachment to patient lives, and the other has a total emotional detachment to their own life. The essence of this story looks to debate two contemporary medical and scientific issues: is it healthy to have an emotional detachment between patient and carer, and when is it an act of mercy to end a person's suffering?

'A Common Thread' (A novella)

Main Central Character: Judith Catchpole

Second Central Character: Prof Richard Charles

Character Development: Judith is a Research Assistant from within the specialist field of psychological anthropology (psych-anth) who has been 'loaned' to Prof Charles. Her supervisor (Prof Eustace) has left the country on an extended period of research, while the psych-anth labs are refurbished and renovated. Judith is convinced that the refurbishment is a ruse - it will never re-open, Eustace will be gone and with it, her research post. The work is planned to take the whole of the Christmas term until after Easter. Judith resides, with her cat, in an old sailmaker's cottage in the unfashionable end of Seasalter.

Professor Charles is primarily a biologist. He has become an expert geneticist on a secured tenure, based on previous profitable patents for the university. Indulged with a 'sweetener', he embarks on a leftfield research project driven by consultancy work, prior knowledge and equipment donated to his department (specifically for him) by the Forensic Science Service (FSS) on its closure. Prof Charles has an initial three months to prove whether the project would be a viable one after that he must return to department work if no progress is made. He lives in the Westgate area within Canterbury's city walls.

Narrative Outline and Contextual Commentary: Prof Charles receives the go-ahead to pick up the project equipment earlier than he intended. He needs to collect on Christmas Eve, so calls on Judith unexpectedly, introduces himself and gives her no choice in the matter but to drop everything and travel to London with him. Judith is annoyed but curious and decides she would rather be working on whatever it is than be at home. Once Christmas Day is over, she does some background research on the professor and his field of study. This is performed in the story outside the plotline, so cuts down on some potentially awkward exposition. Following a short Christmas break, Judith arrives at Prof Charles's lab and he introduces her to the concept of his idea and possible experimental set-up. After a temperamental start, Judith begins to see why she has been loaned out to the professor, as she understands the ties between what she has been doing in her research and what the Prof explains to her about the project. Judith witnesses the experiment fail and is concerned both for whatever is in the machine but also the mental state of the professor. After a few more failures he suggests that maybe the 'historic DNA' (he has acquired) may need an injection of fresh 'life': like an organ donor, the DNA donor needs to be a near match. Alarm bells now start to ring with Judith. She gets into a heated argument and smashes some glassware and cuts herself. She runs out in a blind fury. Judith discovers that her DNA has been combined in the experiment with that of her ancestor, Edmond Catchpole—the source of the historic DNA—and along with her psych-anth work, the resulting 'presence' has acquired a life of its own. She refuses to extinguish anything and so decides to liberate the 'presence' instead and disappears on a short sabbatical of her own.

The extraction of DNA from tissue and other samples (and its analysis) is part of established genetic groundwork research but it is what scientists do with it, is the question. If a sequence can be identified and a genome or genetic map re-built, how far can this be taken? Professor Charles has developed a sophisticated use of a specific software programme (and related FSS hardware) to simulate a personality based on recovered genome and gene sequences – what would this lead to? Given that a life can be lived partly in cyberspace whilst living in the 'real

world', this could have far-reaching consequences. One question that would need to be considered is where would a scientist acquire suitable historic DNA? One source would be through 'harvesting genes' from bodies or artefacts belonging to subjects. Could this be done scientifically and/or legally? When using the software, could the genetic make-up (replicated from the source DNA) be used as a base line and repopulated with a life's worth of experiences (from historical sources), thereby giving the avatar the details and traits of the original person? And if so, could it act independently of the initial programme and become a 'living' software model, capable of thought, speech and action? This line of 'What if?' narrative speculation would bring up more questions than answers, foremost being: would the avatar have a soul?

Developing a methodology for creative practice-based research from scientific knowledge

In the initial stages of developing a suitable research methodology for this study, a collection of science-inspired fiction outlines in the form of seed ideas were identified, based on factual issues in contemporary science. These were sourced from across a range of material: scientists; academics; scientific peer-reviewed papers; science journal articles; newspaper articles; published fiction; conversations with those involved in mediating science and its communication; museum visits and exhibitions. They were inspired by a creative-facing but informed position on the media presentation of science and scientists. One thought was apparent: the continued and increasing influence science (especially genetic science) has on modern life.

From the preliminary choices taken with advancing the seed ideas (using the strands of enquiry identified above), each (proto-) storyline chosen for further development was submitted to a number of distinct stages. This approach helps to establish a cohesive methodological design and enables decisions to be taken in a structured and planned manner. These stages were a continuation of the work started through the strands of enquiry. They were applied to those potential storyline ideas which would offer the opportunities for developing the most suitable creative practice work to form the basis of the overall research study. These four stages are detailed below:

1. A detailed focus on the presentation of scientific and technological elements of the initial (identified) storyline(s).
2. A critical consideration that considers the current reality and plausibility of the science (and technology) involved in any fictional constructs.

3. An assessment on the factual nature (authenticity) of the science processes undertaken within any aspect of the research fictions.
4. A consideration on the factual nature (authenticity) of the final outcomes of the science as represented within any of the research collection.

With each individual research storyline developed, there was a process of validating and re-validating the 'hard' science[55] involved. With different storylines this process (like those of the 'stages' above) varied according to the needs of how the piece was developing at any given point. I found that a flexible approach as to how and when different aspects were advanced was the most beneficial as information from both specialised and generalist sources would often be uncovered when I was looking for something totally unrelated. The general term of 'hard' science is taken in this research study to encompass reference to scientific papers and research publications which are a result of rigorous empirical and/or peer-review mechanisms, as well as respected scientific journals (including on-line publications) and science-specialist writers. Due to the developing need for dramatic storylines within the research study, this 'hard' science came to include the introduction of fledgling and potential ideas, and concepts of genetic science, engineering and technology in order to open up my creative practice to what Markus Schmidt *et al.* (2013) refer to as a '…sense of possibilities'[56] (p.10), and Gaines *et al.* (2013) as '…novels of ideas'[57] (p.7). Both of these concepts are useful descriptors of my research–based practice. Rather than approaching my writing with a concrete certainty of how I was going to write creatively about contemporary science and genetic science, I use an imaginative approach but temper this with the necessity of plausibility, to keep within the realms of possibility.

In Chapter Six, an indicative sample of both 'hard' science and 'popular' science[58] is considered for each of the individual fictions which constitute my creative work. With these examples I present where a selection of the science and genetic science used in the storylines originates from. Alongside this I relate those storylines to science and genetic science ideas and concepts that are happening now (or may do, in the very near-future). I try to illustrate

[55] Scientific information resulting from rigorous empirical or theoretical investigations.
[56] In a recent paper in the *Public Understanding of Science* journal, Schmidt *et al.* (2013) use the term 'sense of possibilities' to describe both fictions about genuine or authentically convincing science, as well as fictional science elements, within wider fiction (p.10).
[57] Gaines *et al.* (2013, p.7) describe these as works which contain scientific elements along with other aspects from a wide range of styles and genres including romances, mysteries, philosophical or thrillers, and crucially, with authors familiar with and/or educated in the humanities/arts and sciences.
[58] 'Popular' is taken to represent here the more journalistic or commentary-based pieces interpreted from factual science, with varying degrees of accuracy.

this development of my creative practice using a range of different approaches. For that reason, there is a mix of methods and structures represented but these are meant only as illustrative samples. In reality, the development processes for all the pieces of practice work in the collection progressed along similar lines.

The completed practice focuses on presenting pieces of creative fiction that highlight a range of potential effects and consequences for a society as it embarks on human-based, empirical genetic and synthetic biological scientific research[59]. A partial aim of this creative practice is to help forefront and bring the scientific, ethical and moral perspectives, issues and discussions into a popular, public sphere for debate.

As a key element of the research methodology, it was planned that one of the initial pieces of genetic science-inspired fiction would serve as one half of a comparative critical-creative study[60]. The aim of this would be to identify any distinguishing factors which were common across two samples of science-inspired fiction. This approach was based on a detailed critical examination that was carried out (as part of the initial stages of the research study) on Barrett's *Ship Fever* collection of science-inspired fiction. This critique was re-worked and condensed, to provide a framework where direct comparisons of key areas between science-inspired fictions of similar form could be undertaken. (An applied version of this study can be seen in Chapter Five.)

This initial study framework also proved useful in identifying a representative sample of genetic science-inspired fiction, which in turn provided samples of both published and e-published works, that helped inform my practice-based writing as research.

The reading and awareness of genetic-inspired science-as-fiction ranged across novels, collections and individual mixed-length fictions. It includes: *Generosity* by Powers (2011), *Intuition* by Goodman (2009), *Bio Punk: Stories from the far side of research* edited by Ra Page (Comma Press[61], 2012), and e-published works on Rohn's webzine *Lablit.com*[62],

[59] A recent paper in the *Public Understanding of Science* journal on this debate (Schmidt *et al.*, 2013), refers to a similar approach to contemporary creative work, as 'Diegetic Prototyping' (p.1), which uses technologies and science currently on the 'drawing board', as potential avenues of inspiration for creative fiction pieces.

[60] Boulter (2007, p.2) suggests that a creative writer's work benefits from that writer being able to critically appraise their own work and feed this back into their creative process.

[61] Comma Press have published three collections of short stories: *When It Changed* (2009), *Litmus* (2011) and *Bio Punk* (2012), which tackle the main subjects of: science into fiction, modern science and the far side of genetics/genetic science research, respectively.

[62] Rohn's webzine is an invaluable resource. It brings together the worlds of 'Hard Science', 'Popular Science' and 'Science-as-Fiction' and offers a platform for aspiring writers of science-as-fiction to be e-published.

including ‘An investigation into love by Babcock and Wainwright’ by Pippa Goldschmidt (2015).

Although the fictions in my collection can be individually considered as standalone pieces they have been written to be read collectively and consecutively in the sequential order as presented. As my pieces progress, there is less emphasis on explaining the minutiae of genetic processes (i.e. extracting human genetic material from tissues, blood and other organic matter) involved in working with samples to obtain either identification indicators or for use in experimental manipulations. This information is mainly contained within the novelettes, ‘The Commuter Lab’ and ‘The Patient Experiment’. As a result, details of standard genetic processes, such as using a PCR or ‘Polymerase Chain Reaction’ machine to produce a working sample of DNA for laboratory procedures, becomes less important in the structure of the creative practice. As the reader moves from one piece to the next, the procedural information already provided is not repeated in the same detail. This approach is evident in the structure of ‘The Commuter Lab’ as opposed to ‘A Common Thread’, where different aspects of (factual) medical genetic science are brought to the fore within the novella, even though some of the knowledge from ‘The Commuter Lab’ required for ‘A Common Thread’ is not detailed. The research practice collection is to be seen as a progression both in exploring the writing of genetic science-inspired fiction and in the ability for the complexities of a subject—here it is genetics—to be built upon and compounded, with a structured, linked collection of creative fiction[63].

Selecting a corpus of work for an examination of science-as-fiction literature

One key area of the research study undertaken at an early stage, was to use the research categories outlined in my critical analysis study of Barrett’s *Ship Fever* collection (see Chapter Five), to inform a comparative study between Barrett’s piece, ‘Birds With No Feet’ and one of my own practice collection, ‘The Patient Experiment’ (again, see Chapter Five). In turn, this comparative study helped to identify a selected corpus of work (that proved useful for both critical and practice purposes) as it provides a body of published fiction which exhibit substantial science-as-fiction credentials[64].

[63] Wherever possible I do not repeat factual descriptions and subject explorations to avoid duplicating material across the creative practice pieces as they progress. Where those details are not required, they have not been included.

[64] A selection of these were detailed earlier on in this current chapter.

Through the selection of this corpus of recently published popular fiction works that feature science and scientists in recognisable and contemporary settings, the role of science-as-fiction through its central character's experiences and personality can be appropriately appreciated, studied and critiqued. Rohn's *Lablit.com* was a good starting point for selecting/confirming the corpus. Rohn's notion that the science undertaken (and the scientists undertaking it) should be '…integral to the plot…' (2005b) has found resonance with my own practice and critical research study endeavours.

The process for the selection of the corpus was developed to achieve a suitable cross-section of contemporary fiction material, relevant to both the critical research study and my own creative practice. For a detailed examination of this selection process, see Appendix (iii).

Closing Chapter Statement

Through an illustration of some of the stages of character development and storylines for each fiction, along with the approach of aligning the creative practice, the boundaries posed by plausible science and the demands of the research study in delivering appropriate material, I offer an examination of how and why I developed the study's creative element. With this chapter, I present evidence of a methodical and carefully planned process. This may seem a little at odds with 'creating' an element of artistic work, and aspects of this are borne out as I approach the needs of presenting (factually based) science and genetics as plausible concerns alongside the creative imaginings of each piece. Nevertheless, the steps taken to produce practice, and meaning through that practice, demonstrate an inventive and novel approach in creative design and reflection (praxis) within the spheres of science-as-fiction and speculative fiction. In the next chapter, I discuss the approach taken to developing the critical work through my creative practice set against a background of balancing the formal demands of fiction with those of the associated science content.

CHAPTER FIVE

Developing a critical-creative approach to practice and research and the integration of science and fiction

Placing this element of the practice study into context, I would like to offer a brief insight into how this approach came about. In the developmental stages of deciding on a specific topic and creative approach (for the overall doctoral study) I relied very much upon the knowledge and experience from the analytical work I had been engaged with in my early research. After many different considerations, I settled on initially outlining the approach taken by a successful and contemporary-produced collection of science-in-fiction in the form of Barrett's *Ship Fever*. As I became more engaged in how this text was constructed and written, I inevitably found that the best way to fully uncover/understand was to undertake a comprehensive structural and evaluative analysis of the individual fictions found in Barrett's book. (This led subsequently into embarking on a comparative analysis with one of my own pieces but was not an original intention, as I had only begun the outline drafts of what was to become my creative work collection). In preparation for this structural and evaluative analysis, I devised criteria with which to examine various aspects of the writing, structure, character construction and the integration of the science involved. Some of these criteria were a good fit and some were not. As the initial work was carried out it become clear that out of the original six categories for the selection criteria (Criteria 2.1 - 2.6), only three were relevant for the purposes of this research. These are labelled below as 2.1, 2.2 and 2.3. (There is more information on the detail of the chosen criteria in the following sections.)

As a result of engaging in a critical examination of *Ship Fever*, it helped to situate my prospective work in a more informed and confident position with respect to developing my own creative practice. The analytical work carried out on Barrett's collection enabled me to consider what I wanted to write and how I wanted to write it, along with a realistic aim of writing in such a way as to infuse my practice with a science communication element. In this way, I have been able to inform and address my practice-based research from a creative and critical perspective.

The pieces in Barrett's *Ship Fever* range from 4,400 – 34,600 words. The collection can be regarded as a compendium of mixed-length fiction with a shared interest in scientific-related characters, science (in a very diverse context) and the humanity of the characters involved. The pieces are a mixture of ideas- and character-driven fictions. Although the forms of the individual pieces are varied in length with examples of shorter fictions (short stories), longer

fictions (novelettes) and a novella (the title piece), the collection is most notably a (theme-) related group of fiction of which some engage in more character-development and story-depth than others, as and when required. There is no standard narrative approach taken, and the type and form vary from piece to piece. What each fiction does have in common is an individually drawn small collection of characters that function with one main story arc and for the most part, accompanied (for the most part) by a secondary or subsidiary storyline. In order to illustrate the diversity in the range of length, type and form and to put into context Barrett's collection, I have used my earlier structural and evaluative critical analysis of *Ship Fever* to present a summary section detailing length, type, context, synopsis and form for each fiction in the collection (see below).

The collection of texts in *Ship Fever* is what has most influenced my approach to writing and story construction, not only in topic or theme but also in a structural consideration. It was the form of the novella or novelette that I felt best suited my characters, their stories and the genetic science-themes[65]. In light of this I was following in the footsteps of an established path - Barrett's *Ship Fever*. Each of my pieces for the research study were written to engage a reader with a theme through the experiences of a central character (or characters). The themed collection that I wished to create (if my practice functioned the way I designed for) could also help to present some aspects of (genetic) science (communication) to a general reader in an environment which was familiar and not alien to their experiences and pre-conceptions of empirical science, and the scientists responsible for carrying those processes out.

A contextual summary of Barrett's *Ship Fever* collection

With *Ship Fever*, Barrett makes use of a mixed approach to form, type and length in the fictions contained in her 1996 collection. To illustrate this approach with reference to my own collection—for comparison purposes—I have used the definitions of type as indicated by Tuttle of 'novella', 'novelette' and 'short story', discussed in Chapter One.

STORY 1: 'The Behaviour of the Hawkweeds' (Novelette: 11,900 words)
Time frame of the story: 1856-1980.
Synopsis: The science of hereditary is interwoven with an academic, his scientist wife and a fake heirloom.

[65] If this is classed as engaging in an 'experimental' approach to constructing form, then I would not be averse to using this descriptive term.

Form: The structure is one of recalling the past and associated memories. It is presented as 'blocks' of sub-stories, told in one overall shell—or metanarrative—as the main character, Antonia, recalls the rise and fall of her husband's academic career. This allows the narrative to seamlessly include smaller stories or anecdotes of 'recalled' or historical events that work in a fluid way with the topics of genetic and hereditary science, as pieces of the fiction can be inter-linked as a reader moves through the landscape of the novelette and the narrator's timeline of events.

STORY 2: 'The English Pupil' (Short Story: 4,500 words)
Time frame of the narrative: 1777.
Synopsis: An elderly Linnaeus reflects on his legacy of a universal taxonomic system and the sacrifices he made to achieve this.
Form: The pursuit of science in 'The English Pupil' (by both botanists and natural scientists) is made up of a collection of very short tales, that get straight to the point. This style aids the delivery of the main narrative as the reader is drawn in from one sub-story to the next, overseen by Linnaeus's thoughts and regrets.

STORY 3: 'The Littoral Zone' (Short Story: 4,400 words)
Time frame of the narrative: 1980-1995.
Synopsis: 'The Littoral Zone' is an eponymous metaphoric tale for the life choices that Jonathan and Ruby pursue after their chance encounter, teaching at the summer camp.
Form: The narrative is structured akin to a lab report and presents a dissection of a destructive relationship that is doomed from the start. It is framed with the logic and rationality of scientific thought, and apart from the initial explosion of lust at the summer camp, it becomes as dispassionate as an experimental procedure.

STORY 4: 'Rare Bird' (Novelette: 7,600 words)
Time frame of the narrative: 1762-1780.
Synopsis: Two female pioneer naturalists challenge The Royal Society as they aim to disprove a classical theory through experimental observation.
Form: The issue of 'science' is skilfully woven into the narrative and is assisted through debates that are easy to follow and both positions being presented. The structure of the fiction is reminiscent of an experimental procedure. There are three main areas that highlight the process of engaging with science in the mid-1700s. All are carried out with a deftness that does not draw attention to the scientific mechanisms involved.

STORY 5: 'Soroche' (Novelette: 8,300 words)

Time frame of the narrative: 1835-1980.

Synopsis: A woman dwells on her fall from grace, a lack of genetic 'fitness' and her late husband's ancestry stretching directly back to Darwin's South American 'Voyages of Discovery'.

Form: 'Soroche' is the most speculative of Barrett's collection. The science, as such as it is, is delivered in a metaphorical way and hinges mostly on an interpretation of Darwin's "On the Origin of Species". The main narrative strand concerning Captain Fitzroy (of *The Beagle*), flows in and out of the structure as incidences of 'told' stories and drifting memories, derived from a descendent of the (factual) Chilean natives who accompanied Darwin on his expeditions to Tierra del Fuego.

STORY 6: 'Birds With No Feet' (Short Story: 7,200 words)

Time frame of the narrative: 1851-1862.

Synopsis: The nineteenth-century world of the naturalist is explored through the pursuits of two proto-botanists as one struggles to achieve the recognition and economic standing of the other.

Form: The naturalists Alfred Wallace, Titian Peale and the fictional Alec Carriere are portrayed as scientific adventurers, competing to discover new species. While in South America, Wallace befriends Alec and their journeys and hypotheses are shared through chance encounters, tales, correspondence, papers and journalism. From a structural perspective, Alec is used as a narrative device to (imaginatively) unfold Wallace's hypotheses and thoughts, to illuminate his part in the co-discovery of the 'Theory of Evolution by Natural Selection', with—but independent of—Darwin.

STORY 7: 'The Marburg Sisters' (Novelette: 13,000 words)

Time frame of the narrative: 1957-1990.

Synopsis: Two sisters, Rose and Bianca, explore the science involved in viticulture from opposing ends of the bio-chemical spectrum, all set against a backdrop that debates the 'cult' of science.

Form: This episodic contemporary narrative lacks the hindsight of the more historically based science pieces to excite with a familiarity, that those fictions bring. 'The Marburg Sisters' does have one key narrative distinction: it is able to instil a literary merit through prose, scene-setting and the treatment of characters. This approach immerses the reader in

scientific terms and processes—over its four distinct parts—as the narrative details the imagery and audio of scientific practice, with applied clarity, to create a tale of 'literary science' (science-in-fiction).

STORY 8: 'Ship Fever' (Title piece) (Novella: 34,600 words)
Time frame of the narrative: 1846-1847.
Synopsis: Medical and 'outsider' science confront each other as the spread of Typhus or 'ship fever', caused by the mass emigration from Ireland to Canada in 1847, threatens public health in Quebec.
Form: Dr. Lauchlin Grant and Nora Kynd meet under tragic circumstances: he is an ambitious but limited medical practitioner and she is an émigré who carries with her decades of inherited 'outsider' medical knowledge. As an integral part of the narrative there is a continual discussion delivered through Lauchlin's thoughts, conversations with Nora, and research on scientific papers and texts. Lauchlin extends this debate through his journal and letters to friends and family, in a multi-layered narrative structure set in a real-world environment.

From applying a standard numerical analysis using these definitions, the *Ship Fever* collection contains one novella, four novelettes and three short stories. My own collection contains one novella and two novelettes (18,600 words, 17,000 words and 13,200 words, respectively).

In comparison to Barrett's *Ship Fever* collection, my practice research is narrower, across form, type and length. My pieces, in numerical terms are more closely grouped together and in form, are more aligned to a single overall approach - that of contemporary speculative science-as-fiction, centring on science and genetic science. Although my approach is narrower than that of Barrett's, there are some wider aspects of form within my pieces such as the threads of a thriller, an investigative structure and detective-type elements, although the most prevalent feature are character-centred narratives that focus on science and genetic science. Barrett's collection exhibits a wider mix of type and fiction lengths, that range from short story to novella, and a wide approach to form. Across the eight pieces that make up *Ship Fever*, there are a range of historical science-based pieces and some that cross between historical and contemporary; contemporary or modern fictions; pieces that discuss natural history and hereditary; some that allow a reader to experience contemporary science processes, and others that provide an insight into the processes of Mendelian inheritance and proto-genetic science. Overall, Barrett presents a collection that is infused with science but not about science, that uses a mix of historical characters, situations and locations, whilst

positioning fictitious characters and fictitious situations to interact with historical (science) fact. This results in a human-interest literary collection that concentrates on the trials and tribulations of its characters in worlds embedded in science and the natural environment.

From this perspective, the pieces in my speculative science-as-fiction research collection have little in common with Barrett's. I believe that this would be a mis-representation because the aspect of form that both collections have in common is the application of how science and the processes of science affect the main characters—often determining their futures—and how they act and re-act to this in the narrative.

Analysing the *Ship Fever* collection and undertaking a comparative analysis

This section includes a detailed and indicative sample of my critical analyses of Barrett's texts and a sample of the resultant comparative analysis between an original piece of fiction and one of Barrett's pieces from *Ship Fever* (the remaining categories of the comparative analysis are included as Appendix (iv)). As indicated, the inspiration for this idea of undertaking a comparative study came through the work which was carried out during the critical examination of Barrett's texts.

My initial approach considered whether a framework could be identified to establish an appropriate method(s) for delivering a piece of science-as-fiction writing as part of a proposed PaR study. In analytical terms, the object of investigating a literary collection of science-themed fiction through employing a systematic methodology, offered a concrete and manageable way forward.

An analytical examination was undertaken in the form of a detailed written analysis of the *Ship Fever* collection. This work took the form of a close-reading of each of Barrett's science-as-fiction pieces (of varying length)—including the title novella—from the collection. It considers how scientists (both amateur and professional), science and the notion of science are utilised and put to work in each fiction. (This follows on from an earlier attempted framework to consider the most appropriate methods for selecting the format and material of a contemporary representative sample of available science-as-fiction literature [66].)

Component Elements:

A. **Critical Analysis: Approach and Criteria for Critical Study**
B. **Comparative Analysis**

[66] 'Selecting a corpus of work for an examination of science-as-fiction literature', Chapter Three.

A. Critical Analysis

The critical analysis criteria devised for the initial Barrett/*Ship Fever* study were as follows.

Order #1:

Think about what is happening to the science and the scientists (main and secondary characters) in the fictions within the *Ship Fever* collection and consider:

i. Areas of Science (and the scientist characters)

ii. Areas affected by the science

(Analyse and summarise i. and ii. In relation to Order #2)

Order #2:

Examine each of the fictions to see how the scientists and science are treated (and identify the science/process involved) through the following three criteria[67]:

2.1 The way the science is integrated into the storyline. Does the science become a 'key feature' of the narrative driving the plot on? How and why does it work – seamlessly, noticeably?

2.2 The practicalities of using science as an object of literary investigation[68].

2.3 The practical and structural story elements. How to show or reveal the process of engaging with science without it being seemingly too obvious.

B. Comparative Analysis

Following on from the results ('findings') of the initial analytical study, an in-depth comparative analysis was undertaken to examine (or test) one of Barrett's fictions, against one of my practice research pieces, under the title of: 'Storytelling and scientific culture in literature: a comparative analysis of two tales of science-as-fiction literature.' The two pieces that were chosen were 'Birds With No Feet' (from Barrett) and from my own science-as-fiction collection, 'The Patient Experiment'.

Refining the analysis criteria from the initial close-reading critical analysis (from A.), this comparative and critical study (B.) sets out to further consider one of the pieces from Barrett's *Ship Fever* collection in an effort to identify suitable factors/parameters for the comparative analysis of an original, science-based fiction.

[67] There were initially six trial categories for Section 2, but only three criteria returned relevant results.
[68] For the research purposes with this investigation, I will consider this as how science can be utilised within a storyline to help drive the narrative to its conclusion.

It was hoped through using the same analytical parameters to examine both pieces that a useful comparative study could be made between the two fictions. These findings helped the refinement of the analytical criteria to produce a series of six categories, through which science-as-fiction pieces could be analysed, either as a comparative study or in isolation. It is anticipated that this will be regarded as a suitable analytical framework and could be used as the basis for a critical examination of any given appropriate selection of work. An example of how this process was undertaken and the comparative findings it produced, is presented in Section B. (below).

Findings from A. and B.

Presented here as a sample of how an analysis was undertaken is the example of Barrett's sixth piece in *Ship Fever*, 'Birds With No Feet'.

A. Critical Analysis

STORY 6: *Birds With No Feet*

Time frame of the story: 1851-1862.

Order #1: Think about what is happening to the science and the scientists (main and secondary characters) in the fictions within the *Ship Fever* collection.

Summary Points

i. Areas of Science

Natural scientists and the developing science of Evolution (mid-nineteenth century) are the foremost science aspects in 'Birds With No Feet'.

The natural scientists, which encompass the characters of Alec Carrière (most likely fictional) and the factual and notable natural scientists such as Wallace, Titian Peale and William H. Edwards, are portrayed as scientific adventurers[69]. They are keen both to make a name for themselves through the discovery of new species and developing theories but also (initially) make a living to support their work until patronage materialises. Their particular situation aligns itself closely with the notion of 'survival of the fittest'. The main character of Alec does not appear as fortunate as his (factual) counterparts. He seems destined to be in the shadow of Wallace, always one or two steps behind. Their paths eventually do cross and they briefly meet as equals but almost instantly Alec is left behind in Wallace's scientific wake.

[69] Links well with Haynes' portrayal of 'The scientist as adventurer' (2003, p.250).

Alec is introduced (via a flashback) as being interested enough to teach himself the basics of taxidermy and taxonomy. He has the drive to seek help and advice from the Philadelphia Academy of Natural Sciences on how he can pursue a practical career as a naturalist (to collect and supply specimens). Alec envisions this as initially being a move to make the money he needs to study in a more formal setting. An important distinction is drawn here between 'working' scientists and 'gentleman' scientists, and between those in the New World and those in England/Europe.

The scientific process of the mid-nineteenth century naturalist in foreign climes is interestingly documented and introduces the many skills needed to undertake the field work. Also detailed are the hazards (fire, disease, hostile conditions, long and dangerous sea-bound voyages etc.) that many of these (factual) naturalists faced and fell victim to.
The development of (some of) the accepted evolutionary theories (from Wallace's point of view) are deftly handled both in a conversation and a narrative letter, and also in showing the (possible) progression of Wallace's hypotheses, through the experiences of Alec.

There are fringe areas of science too which manifest themselves near the end of the story, that may just be fanciful ideas or written to possibly reflect some of Wallace's (later) more metaphysical and spiritual concerns of evolution: destruction of a finite species/habitat in the name or service of science, and the de-population of rain forests by man and the cloning and re-population of those lost species—'another theory of evolution' as Alec put it (p.122)—from collections harvested at an earlier time.

ii. Areas affected by the science

As with most of Barrett's fictions set in the mid-eighteenth and mid-nineteenth centuries (in this collection), there is the idea of a 'gentleman' scientist versus the 'working' naturalist/scientist. This comes very much to the fore in 'Birds With No Feet', not because one type is pitted against the other but because aptitude and luck also seem to come into the equation. Both Wallace and Alec start off from a level footing but as Wallace rises, so Alec falls, and the equilibrium is restored.

A key point in this story is that there are those who do a good job and end up with little to show for it, and those who similarly do a good job but benefit from being able to appreciate the bigger picture. The capacity to possess an overview is something Alec can only admire in Wallace but never emulate. This is shown to good effect in Wallace's hypothesising on the diversity and multitude of animals and insects they find in the rainforests, 'Where had all these creatures come from?' (p.113). Only Wallace contemplates this; Alec's mind is elsewhere. This hypothesising is what makes the mid-nineteenth century

naturalist collector, a scientist. He is then able to move up a 'career ladder' via peer reviews, patronage and the joining of the establishment (in this time and place, The Royal Society). Alec doesn't quite grasp this. The issue of being a 'self-taught' naturalist comes into this story but also acknowledges a scientific supporting network, without which none of these naturalists would have been able to flourish.

A central theme in 'Birds With No Feet' is to enquire, 'What is all this science for?' (both in the context of this story and from an historical perspective). The observations made *in situ* and collections taken for scientific purposes were probably only a fraction of the species that were trapped and killed. Both Darwin and Wallace (seem to have) spent large portions of their lives visiting (mainly) South America (and associated islands) on field trips, and undoubtedly many of the observations made of animals in their natural habitats helped them form and develop their hypotheses. Their own collections provided hard evidence (e.g. finches' differing beaks etc.) but an overwhelming amount of collected (killed) specimens were for private and/or museum collections. This opens up an area for discussion with the story: Is it in the 'service' of science to de-populate a rain forest or steal an area's resources, or to drive to extinction a species because it looks aesthetically pleasing housed in a glass case, in the hallway of a house in Kensington? This type of question is raised (theoretically) by both Wallace and Alec, especially at the point (in the latter's case) where he possibly faces his own extinction, as he heads off to enlist to fight in the American Civil War (most likely on the Union side) and the blockade of Richmond, Virginia (circa July 1862).

Order #2: **Examine each of the fictions to see how the scientists and science are treated (and identify the science/process involved) through the following three criteria.**

Criteria 1 - **The way the science is integrated into the storyline.**

In this story 'Birds With No Feet', one major element of the science involved is directly tied to the storyline itself. The fictional main character—Alec—is aligned closely with the progress of the narrative. He is a fictional rarity amongst a cast of notable scientists and naturalists, and because of this is a malleable and functional tool in order to investigate the ideas, thoughts and background of Alfred Wallace.

Alec can be seen as a slightly skewed mirror image of Wallace but without the (formal) scientific background knowledge, inclination or capacity to appreciate his surroundings, or even to grasp the bigger picture. As a result of this he is always regarded as an inferior naturalist (and possibly not even a scientist). However, Alec is very useful as a narrative device to be able to hypothetically unfold Wallace's hypotheses and thoughts, on the way to

him developing his joint-role in the co-discovery of the 'Theory of Evolution by Natural Selection', with—but independent of—Darwin.

At the beginning of 'Birds With No Feet', Alec is informally revealed to the reader as he develops the tools of his naturalist trade both from a scientific and practical point of view. He is aided by inspiring textbooks such as Edwards' *A Voyage up the River Amazon* (1847), and through the patience and altruism of established naturalists and scientists (in the form of Titian Peale). Aspects of exploratory field science are shown as Alec progresses and learns his trade. Later in the story as Alec's fate becomes inevitably entwined with Wallace's (and his world), scientific thoughts and ideas are established and disseminated through conversations, letters, thoughts and reflections on what Alec has seen and done in his naturalist life. Although some of the science and processes are straightforward and logical, there are still some aspects which need careful consideration and reading, especially some of the more ethical or metaphysical points suggested near the end of the story (e.g. the decimation of the diversity of the rainforests).

Criteria 2 - **The practicalities of using science as an object of literary investigation.**
Again, like 'Rare Bird' (story four) part of the practical problem of being able to revisit contemporary science-as-fiction and discuss the science (in that context) is overcome, as 'Birds With No Feet' takes place a good distance back in time, and so the developments and consequences of those ideas (e.g. evolutionary theory) are well thought-through. Here it is the period immediately pre-and post-evolutionary theory and its publication, in papers by Darwin and Wallace (1858).

The discussion of evolutionary ideas, hypotheses and theories that run through the story work well as literary objects. This is due in part to the continuing interest and debate in evolutionary theory. It also helps that the science involved relates to real-world issues that people/readers can relate to (e.g. survival of the fittest, gene pools, hereditary factors etc.). This is especially true in contemporary science with the sequencing of genomes and genetic engineering. These ideas, hypotheses and theories also tell a story and depending on where you sit on the ideological or theological fence, it could be the greatest story ever told. Having this as the contextual background in which to set a story, goes some way to helping the emerging narrative evolve a strength of its own, as long as it manages (from a reader's perspective) to do the original concepts and ideas justice.

Criteria 3 - **The practical and structural story elements.**
The process of undertaking science in 'Birds With No Feet' is found within the story itself. The narrative centres on the fictional character of aspiring professional naturalist Alec and

the progression of his dream. Through his collecting pursuits he wishes to make a name for himself and enough money to formally study in Philadelphia. As the story unfolds, he loses some of this ambition and realises that he would happily settle down with a wife and family, using the money earned from the collection and selling of exotic animal specimens. As a reader, we follow his naturalist (scientific) pursuits.

This approach enables Barrett to describe in great detail the process of these 'naturalist collectors' and the scientific skills and knowledge their work entailed. In part due to the factual scientists chosen as supporting characters to Alec and his naturalist career, the process of undertaking science on a larger scale (i.e. the development of 'evolutionary theory through natural selection') can be tackled almost first-hand. This is deftly achieved by placing Wallace in the same narrative sphere as Alec, just at the time (and place) when Wallace was developing (and voicing) his hypotheses.

From a structural point of view, this story is designed to be able to allow Wallace and his ideas (and rise in scientific standing) to be freely used and to drive Alec's story (demise) forward at the same time. On a practical level, this is done through their initial meeting in 1851 at *Barra* (Amazon Delta) and their letters, anecdotes from others, their last meeting in 1855 (*Borneo*) when Wallace has Alec 'rescued' and subsequent correspondence, and finally a newspaper report (scientifically and physically losing touch), up until Alec's entry into the US Civil War in the early 1860s (most likely in 1862, Richmond, Virginia).

There a couple of curious revelations to do with the process of undertaking science in 'Birds With No Feet'. These may well be the writer's fictional meanderings but with Wallace, Barrett seems to suggest that his great evolutionary theories were formulated, or at least pieced-together, during his frequent bouts of fever—malaria—whilst abroad on his naturalist field trips. Although these are not quite 'Eureka' moments, given Wallace's later thoughts and fascination with spiritualism and metaphysics, and the question of the 'soul' in evolution, this is an interesting element.

However gloomy Alec's future is to be—possibly as a casualty of war—Barrett does enable him to draw some potential connections Wallace did not seem overly concerned by: as the rainforests present a finite source, all the collecting and interference will create extinctions. Alec's own theory of evolution is that the 'dead' collections will bring life back to the forests where the species will live again. This is a timely nod to cloning/genetic engineering and the repopulation of depleted or extinct ecosystems.

Please Note: With the 'Birds With No Feet' example, I have provided the critical analysis in full detail to give an idea of the scope that could be available with such an approach.

Although there is further complete analyses of Barrett's *Ship Fever* collection, it was judged that one full example would provide a suitable level of detail to illustrate the origins of my critical analysis and reflective research approach for this practice-based study.

B. Comparative Analysis of Creative Practice

Storytelling and scientific culture in literature: a comparative analysis of two tales of science-as-fiction.

Refining the initial criteria from the above critical analysis, this study sets out to further examine one piece chosen from Barrett's *Ship Fever* collection—'Birds With No Feet'—in an effort to identify suitable parameters for the comparative analysis, when set against an original, science-as-fiction piece from my own collection. Through using the same factors to examine both tales, a comparative study can be made between the two pieces. This approach could lead to identifying a suitable analytical framework that could be used (for future research) as the basis for an examination of an identified corpus of work[70].

Refinement of the Comparative Analytical Criteria.

Categories:

i. Perceived intentions of the author.
ii. How science and scientific culture fits into the world of the story.
iii. By what method is science and scientific culture disseminated in the story: as metaphor, as a sociological factor or as a philosophical factor?
iv. Is the science and scientific culture a component of the narrative or does the narrative rely on the science and scientific culture for the narrative to work?
v. Is the science and scientific culture an accurate, or at least plausible, representation of a 'real-life' scientific experience?
vi. How is the science and scientific culture revealed in the storytelling: first person; letter; journal; third person; omnipotent narrator or a combination of all these mixed approaches? And by whom (their role) as: direct experience; past experience (memory); indirectly (second-hand) or just through pedagogic dialogue, in a more didactic manner? What effect does this have on the style of storytelling?

[70] A suitable corpus of work was identified in the development stages of this research study (as indicated in this chapter, and in Chapter Four) but the proposed examination using comparative techniques was not carried out, as the principal focus of the research study evolved away from this approach.

Application

Using each category (where appropriate), consider a Barrett fiction and one of my own original pieces. Compare the analyses and draw out subjective but informed points for discussion.

Chosen texts

'Birds With No Feet' by Andrea Barrett (AB) (Taken from *Ship Fever*).
'The Patient Experiment' by Sean Fitzgerald (SF) (PaR creative work collection, 2011-18).

A critical analysis derived from a close-reading of Barrett's 'Birds With No Feet', is provided earlier in this chapter. For any comparison to be effectively realised, a corresponding approach to my own piece, 'The Patient Experiment', is required before any comparative analysis can be explored. The evaluation of this additional close-reading is provided below.

Critical Analysis

The Patient Experiment

Time frame of the story: Late 2010s.

Order #1: Think about what is happening to the science and the scientists (main and secondary characters) in the fiction.

Summary Points

i. Areas of Science

There are three distinct aspects of science that provide the main scientific discussion points in 'The Patient Experiment'. The first is broadly the science of 'near-death' studies and the biological, physiological, psychological and theological elements that feed into this multi-disciplinary area. The second is the science of genetics and genomic research. And the third area encompasses aspects of the biological, bio-medical sciences, specifically focussing on cytology and molecular biology.

The main character, Jake, has a medical background as he is a trained doctor but through circumstances is employed as a psychology research assistant (with light medical duties) at a private clinic, the Centre for Life Experiences (CLE). Jake is keen to start over and is running from an episode in his life that caused a nervous breakdown. He is interested in applying his skills of healing to the mind instead of the body, and so pursues a different branch of medicine.

Jake meets his only patient, TP, and is concerned about his scientific and medical duties. He puts this doubt aside and begins to examine TP's case notes. What he finds both astonishes and disturbs him. Firstly, the psychological aspects of Jake's duties towards his patient seem straightforward to begin with but through a combination of circumstances and medical complications, the approach Jake is encouraged to take with TP starts to trigger memories and feelings that he thought had long been suppressed. And secondly, on the medical front, Jake is faced with a shocking situation and truth about the experimental treatment of his patient, in which the manipulation of biological science explicitly plays a key part in prolonging TP's life. Jake uncovers the scientific reasons behind TP's 'condition' - he exhibits an almost impossible genetic trait that allows his cells not to die, if provided with the right biological conditions. TP's genetic make-up allows him to survive 'Reperfusion Injury' that results from Ischemic conditions—such as a stroke or heart attack—through his body's use of 'free radicals' to break down molecules in order to populate his cells with oxygen, if the supply through his bloodstream is cut off or depleted. This ability for TP to survive life-threatening emergencies is only properly effective in dedicated and controlled conditions, and it is here that Jake witnesses the scientific process in full flow, as he is summoned to an operating theatre in the early hours one morning. He is left stunned and resolute.

ii. Areas affected by the science

It is through the characters and not the issues per se that the areas of science are seen to have an impact in 'The Patient Experiment'. Jake, TP, Nurse Arthurs and even the stern, Sister O'Rourke are affected by the practicalities and implications across the broad area science. Their lives are all impacted directly, either through their occupation or on a personal level, when the different aspects of science are brought to the fore in the narrative.

Genetic science and genetic research offer this fiction both a technical framework for the plot to hinge on—TP's condition and the choices it has enabled and/or forced people to make—and of the scientific detail behind a covert research project undertaken by the CLE. It is this corporate venture that ultimately drives the funding and persistence of TP's longevity, and in the end, sanctions its prize asset to succumb to his mortality as the successful treatment programme is delivered (at The Harvey Clinic).

As with many issues of morals and ethics linked to genetic research, there is a never one clear 'right' or 'wrong' position to hold. In this story there are a variety of shades that run from light to dark. As a reader, some positions are more sympathetic than others but there is not an over-riding moral or ethical viewpoint presented with this piece. Both Jake and TP know (eventually) what is at stake and both hold ethically ambiguous positions: Jake knows

he has to make amends for himself and for TP and is prepared to ultimately sacrifice himself or his career, and TP understands his 'golden goose' position and uses it to provide for the future security of his whole extended family, even though he is aware what the treatment is, that the Harvey Clinic is developing. The staff, including Nurse Arthurs, are complicit in the procedures employed at the CLE and are aware of some of the business of The Harvey Clinic. She regards it is a well-paid post, that is perfectly legal if a touch morally ambiguous.

There are several mentions of 'near-death' in the fiction in relation to Jake understanding TP's condition and carrying out further research in an effort to help both TP and himself. Although 'near-death' studies do consider other factors, there is science at the core, as it is the science of the body and mind reaching an unsustainable point and 'shutting down', only to be revived. The effects of this biological and psychological 'shutting down' lead to a number of different substances and toxins being released into the bloodstream that both cause the revival but also can cause hallucinations. Jake tries to put what may be happening—into some sort of medical context—when TP is effectively 'resurrected' after a normally fatal severe cardiac arrest.

Order #2: **Examine each of the fictions to see how the scientists and science are treated (and identify the science/process involved) through the following three criteria.**

Criteria 1 - **The way the science is integrated into the storyline.**

In 'The Patient Experiment', Dr. Jake Balfe's main scientific role is as a researcher. In a trade-off for the academic and intellectual freedom he is afforded in this role, he has light duties as a first-point contact for TP's medical and psychological wellbeing. As a researcher, he decides to focus on TP's psychological state and how this may be affecting TP's judgement in agreeing to continue with the CLE's research programme and 'treatment' involving continual resuscitation. Jake notices a pattern of 'slowly spiralling degradation' (p.64) in TP's records and correspondingly uncovers evidence that the centre has suppressed earlier concerns raised by his predecessor, Dr. Kyrstal Lenka.

In his role as a psychological researcher, Jake is an investigator. His role in the storyline is to drive the narrative forward by discovering or uncovering the truths about what is happening to TP, why is it happening, how he can assist TP and ultimately, where he fits into the scheme. Uncovering the truth of the science behind TP's ability to enable continual resuscitation to happen offers a framework for Jake to understand (and with it, the reader) how all the story elements fit together, and structurally how the narrative progresses along investigative lines driven by Jake's scientific and medically based research.

As well as being new to the role of a scientific researcher, Jake is also new to the medical areas of psychology and psychiatry. This unique position offers the reader the chance to learn when Jake learns, and to discover about TP's condition and likely prognosis, alongside the character of Jake. The plot is structured for the reader to be closely aligned both to Jake's experiences and position in the narrative and so, discoveries he makes and conclusions he draws will have more of an impact in terms of reader experience.

Criteria 2 - **The practicalities of using science as an object of literary investigation.**

The main location for 'The Patient Experiment' is the fictitious Centre for Life Experiences (CLE) in a representation of Oxford. This scientific medical research facility is presented as a private hospital—and leaving politics aside—with all the positive connotations that most thoughts of hospitals would engender. In portraying science within a recognisable and affirmative setting such as a hospital rather than an unknown or unusual location such as a genetics laboratory or a pathology lab, the issue that a narrative may be about science or scientists and that these may form the focus of the piece, helps to deliver a narrative that has a broad appeal. 'The Patient Experiment' engages a reader with the proposal that science—notably medical genetics, physiology, psychology and cell biology—can be an everyday occurrence that operates within a familiar landscape which does not seem forced or out of place in a general fiction, even if characters discuss and uncover scientific facts, information and applied knowledge.

Criteria 3 - **The practical and structural story elements.**

The focus of Jake in his pursuit of truth and moral justice is the practical driver of narrative in 'The Patient Experiment'. The character of Jake concentrates on science and in metaphorical terms the character of TP embodies 'science' (in all its forms in this novelette). The issues of science are bound up in what happens to TP in the narrative. The patient's action or passivity (non-action) and Jake's reaction to this, drives the storyline forward as crucial information is revealed at designated points to create an investigative structure.

There is a balance to the narrative in 'The Patient Experiment', that begins with Jake as he brings his personal chaos and emotional baggage into the lives of those at the CLE. This chaos is shared and transferred through his actions to other characters which results in a major event—TP's death and Jake's near-death—from which a new equilibrium emerges.

In elements of the practical and structural narrative concerns discussed above, there are aspects of applied scientific theories in play. Newton's third law of motion states: 'For every action, there is an equal and opposite reaction'. From a Humanities perspective, this could be applied to Jake's character as he interacts with TP, with the outcome being that the doctor,

instead of saving or healing his patient, does exactly the contrary and enables him to die peacefully. A similar science-inspired reading follows Jake's introduction to the CLE, to TP, to his condition, to his treatment, to TP's death and to when Jake completes his tenure. This is mirrored in reference to disrupting a state of equilibrium: It begins with a settled state, an interruption happens, a state of chaos ensues and finally, returns to an equilibrium.

Complete Analysis Findings presented from Comparative Analysis Research (B.) undertaken between 'Birds With No Feet' and 'The Patient Experiment'

i. Perceived intentions of the author?

AB: 'Birds With No Feet' ('BWNF')

To bring to life an episode in the development of Natural History and the theories of Evolution, through telling the story of a fictional protagonist Alec Carrière—a would-be scientist—set amidst the background of historical characters, events and the culture of scientific enterprise and exploration. Some attempts are made to extrapolate and comment on contemporary ecological issues such as deforestation, denuding of the forests and species extinction through highlighting the research gathering methods employed by these natural historians. The high price paid by the objects of those collections, and in some cases the collectors themselves, are brought into sharp focus. In addition, there are allusions to cloning but these are simply the author's playful speculation with Alfred Wallace's later-life fascination with metaphysics and spiritualism.

SF: 'The Patient Experiment' ('TPE')

To consider issues of science, scientific medical research and the culture in which it exists through the exploration of those issues using a contemporary, linear fictional narrative. The story follows the main protagonist Jake Balfe—a junior medical researcher—as he unravels a mounting conspiracy against a uniquely gifted/cursed patient (and ultimately, himself) whom the research centre no longer has any use for but is unable to dispense with. Within the story content, attempts are made to bring to the fore questions on medical and scientific research, along with those concerning the ethics of human/human-based experimentation.

Comparative conclusions

Both fictions use the medium of fictional prose to explore the culture of science and scientific material in plausible, believable and recognisable worlds.

The main protagonists, from both pieces of writing, are engaged in scientific pursuits but are not perhaps scientists in the strictest sense. They operate along principles of scientific

exploration and within the culture of a scientific community but also are occupied in other matters for their own ends, and not exclusively in the pure pursuit of scientific endeavour. In 'Birds With No Feet' ('BWNF') Alec wishes to gain financial independence albeit to carry on some element of research at the Academy of American Sciences (AAS), but mostly in order to settle down in his home town of Philadelphia. In the case of Jake, from 'The Patient Experiment' ('TPE'), he needs to liberate his charge (ultimately through an act of emotionally driven 'assisted-dying') in an attempt to break away from his troubled clinician past and move on, both emotionally and professionally.

Scientific exploration—or at least investigations using a scientific methodology—are a key factor in these two pieces. This exploration rarely takes place inside a laboratory environment, but they are still located in a 'controlled' and defined space nonetheless: the rain forests of Central and South America and the Asian Pacific in 'BWNF', and the Oxford-based medical research hospital of 'TPE'.

With both, questions on the ethics of the scientific research work carried out in the respective narratives, are put indirectly to the reader. This is something that whilst not directly affecting the reading or understanding of the pieces, it could perhaps be considered on reflection after the story has run its course and may serve a purpose to stimulate or be used, to illustrate debate on such subjects. If this last point is a realistic (albeit indirect) consequence of either or both of these fictions, then a small part of the authors' (unconscious) intention would be realised in opening up (these) areas of scientific culture to a wider, general cultural audience and debate.

The author of 'BWNF' tries to a greater extent to reserve judgement on whether the scientific culture (under the spotlight) is right or wrong. The empathy that is generated for the protagonist—Alec Carrière—is very much through his character and not directly through the voice of the author. In terms of the empathetic relationship with the main protagonist in 'TPE' (Jake Balfe), a similar approach is evident, although the issue of deciding whether the scientific culture of the research facility is right or wrong in its treatment of TP (the object of the story), seems to be more biased against the scientific culture and so to a lesser extent, is left up to the judgement of the reader.

ii. How science and scientific culture fits into the world of the story.

AB: 'Birds With No Feet' ('BWNF')

The world of the story is divided into two distinct areas (between the years of 1851-62): the progressive and scientifically aware North American and European continents where the (old) theories of science (natural history) and the wealth and prestige it can generate are

prevalent, and the South American and Asian Pacific countries which contain the sought-after scientific material. These lands serve as the 'laboratory' for the discovery of the new scientific theories that will shake up the Western world. Alec seems to fall into the gap somewhere in-between the two disparate worlds.

SF: 'The Patient Experiment' ('TPE')

The contemporary world of the story is almost wholly one of scientific culture: medical facilities; journals; research facilities; patients; medical professors and personnel, and technology. Even when the story leaves the physical scientific research/medical buildings, science in the form of research and investigation is still at the centre of the story (in Jake's world). It is partly through the revelation of how much the all-encompassing (scientific) culture at the research facility controls everyone's personal and professional lives that enables Jake to fight back against this culture, which he sees as ultimately self-defeating, harmful, unethical and destructive.

Comparative conclusions

Undoubtedly the two pieces are dominated by their particular scientific culture. In both cases, the narrative evolves from within a scientific culture and is defined by the science (in its broadest sense) that is the subject of each story. This is opposed to a fiction which may have a science-type theme, alongside other central themes but is used only as a narrative element/device within the overall storyline, for example, a genre-defined forensic detective thriller by an author such as Reichs (e.g. *Grave Secrets*).

With both pieces the 'world' of the story is broadly a scientific one (historical natural history and medical research, respectively). The fictions keep to within these worlds almost exclusively with only the merest hint of the outside world visible in both cases (Alec's upbringing and his potential demise in the American Civil War, and Jake's interaction with his neighbour and his 'home' life).

The (scientific) culture of 'accepted' or acquired knowledge underpins both of these pieces. Although the 'new' knowledge and application of this collected knowledge in 'BWNF' (and to a lesser extent with 'TPE') is seen as progressing the respective scientific culture, it is the scientific establishment which ultimately dictates the use of the science (and that culture) under its curatorship.

In both, the main protagonists find the need to push against the system of the particular scientific culture prevalent in that narrative (Academy of American Sciences and Centre for Life Experiences, respectively). This rebellious streak is borne out to some extent by both of these characters—Alec in 'Birds With No Feet' and Jake in 'The Patient Experiment'—finding

themselves as outsiders in their individual scientific worlds. Perhaps, as a rule, the main protagonists in science-as-fiction literature may always need to consider themselves as 'outsiders', despite working (and often living) within the scientific culture that they kick out at.

The narrative journeys which Alec and Jake respectively undertake are ones very much of self-discovery in both personal and emotional terms, and in scientific and cultural terms too. This latterly enables them to question the ethics and the meaning of the scientific activity in which they are individually engaged—as a natural part of the scientific process for them—as they near the end of their respective stories.

See Appendix (iv) for the continuation of the full Comparative Analysis findings for Categories iii – vi (inclusive).

Closing Chapter Statement

The critical and subsequent comparative analyses of Barratt's fiction and my own piece offer a crucial stage in the development of this research study. These analyses are central in the development of the critical-creative method in designing my original work and revising the text and form through content analysis, and consequently, how each fiction matches up to what I am expecting to achieve with it. The analytical framework itself has a dual-purpose: it can be used to undertake a critical examination of a science-as-fiction piece but is also valuable in helping to construct (or design) one too. The notion of what is involved in designing a science-as-fiction work is addressed in the following chapter.

CHAPTER SIX
Creative practice: process, contexts and influences

This chapter considers how a wide selection of material resources related to science and genetic science influences and informs my creative writing practice and the production of the creative work collection. The design of the research practice has been to produce and develop credible genetic science-inspired fiction, populated with believable characters in authentic, contemporary environments, based on ideas generated through science-subject research. To assist in placing the process of this practice in a creative writing context, I will present a reflective consideration on the challenges of communicating science in fiction, directly after the analysis.

The following material consists of an analytic examination of where science and genetic science is situated within each individual fiction. Within this context I offer comments on the interaction between the science, the story and its characters. As part of the overall evaluative reflection, I explore samples of 'hard' science based on solid scientific theory or evidence and 'popular' science, often journalistic pieces built on small amounts of 'hard' science or speculation or from a culturally inspired view of science. This examination of the 'hard' and 'popular' science I engage with to create my fiction offers indicative evidence of a practice-based research that is aware of accuracy and plausibility in its approach.

As I have briefly indicated, the protagonists that feature in my collection are not (fictional) scientists in a classic research sense as suggested by Haynes (1994, p.1) but instead are science professionals, medical specialists, the so-called 'outsider' amateurs, 'patients-as-experts', and so on. This approach is purposefully chosen to address issues of handling exposition in science-inspired fiction. Those characters who drive the plot (in each of the pieces of my creative work) are chosen and positioned in such a way that part of their function is to learn about a particular aspect of genetic-inspired science, or its application through posing a genetic, bio-technology or bio-engineering challenge.

The categories below (for the individual pieces in the collection) offer details of the approach to the factual science and genetic science I employed in the development of my creative work, for each of the research practice pieces. Included are examples of their 'hard' science and 'popular' science (or cultural) inspirations, in varying amounts of detail. The exploration into the background science-subject research is designed to provide an appreciation of and

insight into, the processes of undertaking genetic science as an area of social and scientific endeavour and its relationship to my creative writing as research practice.

'The Commuter Lab': An under-employed science graduate finds himself caught up in an illegal, real-world genetic experiment trapped between a covert governmental organisation and a fringe group of genome hackers. (Novelette.)

The premise for this piece originally centres on amateur scientists and non-scientists as they pursue underground activities in the area of genetic mapping. These take the form of sequencing genetic data and bio-engineering synthetic nanomaterials/biological entities (based on common 'bugs'), as they defy any attempts at regulation by academia or the state, in part due to the establishment's unwillingness to acknowledge either the implications of their experimentation or the near-genius of some of the participants.

'Hard' Science: The initial idea for this novelette came from an article in the *New Scientist* entitled, 'Rise of the garage genome hackers' by Phil McKenna (2009, pp.20-1), which looks into an 'underworld' of amateur synthetic biologists and engineers as they 'tweak' microbial DNA, and specifically talks about terms such as 'bio-weather' (which consists of everyday biological detritus unwittingly discarded such as skin cells, hair, mucus, fingernail clippings etc.) and its role in 'DNA-fingerprinting'. Further areas of 'hard' science were added as the drafting process began and the story required more scientific structure and components. For example, the whole real-world concept of a 'Lab on a chip', which controls small-scale DNA analysis of microfluidic samples was identified from an online article on *Laboratorytalk*[71] about a new product from a UK company, Dolomite Microfluids entitled, 'Microfluids to revolutionise DNA analysis' (*Laboratorytalk*, 2008). This article provides part of the basis for the hackers in my story to be able to analyse the stolen 'bio-weather' sample.

Two subject-relevant genetic science papers, one by Christopher M. Kelty (2010): 'Outlaw, hackers, Victorian amateurs: diagnosing public participation in the life sciences today', and the other from Victoria Stodden (2010): 'Open Science: policy implications for the evolving phenomenon of user-led scientific innovation', were used to contribute to the post-initial drafting process and so were able to be fed-back into the practice-based piece (contributing to the project as writing-as-research). Both of these papers address the rise of amateur genetic science and how it can have its benefits, as well as examining its potential ethical, moral and scientific pitfalls.

[71] An online information service for scientists and laboratory professionals: *Laboratorytalk* (2008).

'Popular' Science: Amongst the fads to emerge in genetic science and engineering, of those both outside and inside the scientific research community is the sampling of freely available genetic data known as 'bio-weather'—referred to as 'bio-trail' in my research practice fiction—and the microbes within this detritus. Initially started as a harmless pursuit looking for patterns in the bio-trail, it becomes clear that the information once collected, analysed and collated could be used to build up a series of effective and highly valuable 'genome geomaps' (categorising the genetic make-up along with distinguishing characteristic indicators) within localities, and more specifically of the occupants of those localities.

An article from the Health section on the *BBC News Online* service entitled, 'Deadly fungus gene code cracked' (*BBC News Channel*, 2005), provides the inspiration for the source of the organic material (a fungus known as *Aspergillus fumigatus*) at the centre of the plot. This is similar to the material which Professor Greg Randall has been genetically engineering, releasing and is in the process of collecting outside of Holborn tube station when this activity brings him to the attention of Peter. In reality, the spores of *Aspergillus fumigatus* are particularly harmful to those people suffering allergies with compromised or weakened immune systems but because this one microscopic air-borne fungus is made up of 10,000 genes (*BBC News Channel*, 2005) there is scope to engineer some of those genes to act in a particular way. In the fiction storyline, this ability to readily manipulate the genetic code of the fungus so it could target and tag inhabitants in the western approaches to the City of London appears to be part of the professor's clandestine research.

With respect to highlighting the scientifically authentic techniques involved in the story, notably the replication of a DNA sample in order for it to be successfully analysed, the journalist and author Ben Goldacre in his attempt to deconstruct the 'myth' of science in his book *Bad Science* (2008), explains succinctly the use of the PCR[72] technique (the same technique as used by the hackers in the novelette) to replicate a genetic sample. Goldacre's investigation highlights the controversy over the poor quality of the (genetic) science involved in creating the media-fuelled, world-wide MMR[73] vaccination scare in 2002 (p.304). It is essential for my creative practice to both be recognised through contemporary scientific techniques and to be in-line with other credible media presentations of those techniques, their uses and the understanding of what they can and cannot do.

[72] PCR: Polymerase chain reaction, which is carried out by a PCR Machine or Thermocycler.
[73] In the UK, the Measles, Mumps and Rubella (MMR) vaccination programme is based on two-single injections recommended for all children in the UK usually between 11-13 months, with a booster given at a later stage of forty months. See NHS Choices (2015) reference for more information.

In the first complete draft of 'The Commuter Lab' its story did continue on after the death of the two hackers, to see a city ghettoised through the extensive use of genome mapping i.e. to keep all those with particular attributes (and imperfections) in one of many segregated locale/s. Although this extended version would push the examination of the societal implications of genetic and genome research, it would lose the immediacy, purpose and plausibility of a contemporary work of fiction (for this research study). With the final draft of this piece, the issues which are subtly raised can be seen to tackle this forward projection.

'The Patient Experiment': A disillusioned junior doctor tries to escape an emotionally driven episode which has blighted his fledgling career, as he seeks solace and purpose as a psychology researcher in a medical care centre only to discover that perhaps some mistakes are destined to be repeated. (Novelette.)

The initial outline (post-subject research) for this fiction concerns the end of a human life, examined not just in scientific terms but also from emotional and philosophical perspectives. Set in a centre for near-death studies, the story revolves around the unusual relationship between a junior researcher and a permanent 'house-guest' of the Centre. The plot follows a journey of discovery as it reveals what lies behind the research focus of the Centre, and the experiences of the junior researcher as he investigates the background and treatment of his mysterious lone patient.

The original idea for this creative practice was sparked by an opinion essay in the *New Scientist* journal entitled, 'Do you believe in miracles?' (Hugh McLachlan, 2009). The author, a professor in applied philosophy puts forward an argument that in an age of science, where the only 'truth' is the one which can be proved and replicated along scientific methods, occurrences which have traditionally been explained away as 'miracles' may just be a set of events which need to be looked at from several viewpoints of which science may just be one of a collective. Professor McLachlan puts forward a range of ideas and points for debate, such as: all events are natural, whether they can be explained or not; there is an element of 'chance' (randomness) in every aspect of life, including scientific happenings; 'miracles' may just be where there is a crossing-point of events not normally connected, and that natural scientific events occur in many different forms (and who knows if we are aware of them all) (2009, pp.26-7).

This compact opinion piece intrigued me and started to spark ideas around a notion of what would happen if a 'miracle' was seen to be happening in the midst of a scientific

environment – how would science deal with this seemingly irrational event? In connection with two other *New Scientist* articles, 'Sleep well, stay sane' by Emma Young (2009)[74], and 'Occupation: lab rat' by Alison Motluk (2009)[75], I started to build up the outline of what would become 'The Patient Experiment'. Although I had the basis for the initial storyline, I felt that there was not that much scope for a dramatic piece with what I then currently had. My research took a slight turn away from the area I was looking into and through a couple of articles (a news release from the University of Southampton[76] and a paper from the *Journal of Scientific Exploration*[77]) I was able to open up the outline of the story to include a 'What if?' scenario of a long-term patient who consistently came back from a state of clinical- or near-death. It was possible to present this as medically and scientifically plausible, through the causes and symptoms experienced by the patient and as a direct consequence of his genetic make-up.

Once I had established a plausible story and could see how the plot might unfold, I continued with my (science-based) research now focussed more on the science of 'near-death experiences' (NDEs). From the University of Southampton's press release[78], I sought out more information on the 'Human Consciousness Project'[79] and was able to access a wealth of research material from the *Horizon Research Foundation* (HRF)[80]. This online resource details many aspects of NDE interest including what is termed 'deathbed phenomena' (DBP) but also aspects of resuscitation (which came in extremely useful during the latter stages of this 'TPE' story development). This HRF material covers scientific, philosophical, social and speculative aspects of the experiences of patients and medical professionals from across an international spectrum. For my own science-subject research, I concentrate on sections from the HRF's findings and consider these in light of the work carried out at the University of Bath by their *Centre for Death and Society*[81] and at the *Centre for Death and Life Studies*[82] at Durham

[74] This article considers the possible links to psychiatric illness and lack of normal sleep or sleep patterns.
[75] This examines an aspect of North American life which allows healthy persons to enlist onto drugs and medical trials, in a near full-time capacity, earning a living wage from the practice.
[76] University of Southampton (2008): 'World's largest-ever study of near-death experiences'. The area that intrigued me was not the 'near-death experiences' (NDEs) but the details of the different types of death which can occur during a cardiac arrest.
[77] Emily W. Cook *et al*. (1998), 'Do any Near-Death Experiences provide evidence for the survival of human personality after death?'.
[78] See University of Southampton (2008) and footnote above.
[79] See Horizon Research Foundation (2008c).
[80] The Horizon Research Foundation is an international research charity based at Southampton General Hospital. See Horizon Research Foundation (2007).
[81] See University of Bath (2005).
[82] See Durham University (2008).

University. The work detailed from these centres offer insights into their methods of empirical investigation and how they use a multi-discipline approach (medical, genetic, biological and physical science) to areas concerning NDE and DBP.

The prototype (science-inspired) storyline idea for 'The Patient Experiment' was two-fold: experimentation in medical genetic science and the pursuit of answers or solutions in the name of (medical genetic) science where compassionate medicine, morals and ethics emerge as second-best. This storyline was never likely to stray into paranormal activity as it considers the scientific experience, purpose and consequences of 'controlled' near-death from a host of scientific disciplines, significantly from a genetic science concern.

'Hard' Science: 'Experimental animal speaks'[83] is quite apt for this fiction. Essentially the patient (TP) can survive persistent clinical deaths. Once I started to investigate the empirically based (medical genetic) science aspects for this story to work (for my practice-based purposes), I discovered a whole range of material which supports a plausible storyline. One of the main pieces comes from an article by Benjamin F. Trump *et al.* (1997)[84] in the journal *Toxicologic Pathology* which provides evidence-based material on cell-death and injury and how, given the right circumstances human cell-death could initially be reversed. Additionally in the article, descriptions of other experimental work being carried out includes information on so-called 'Anti-death' genes and 'Pro-death' genes as Trump *et al.* consider the potential role these may play in being able to reverse cell death (p.82).

A further area where I am able to bring in another layer of plausibility is in reference to a medical condition or effect called 'Reperfusion Injury' (RI). This damage occurs when a normal organ experiences a deprivation of oxygen. I am able to show, through undertaking relevant subject research into the scientific and genetic literature that the ability of TP's (fictional) body to reverse or resist any RI is plausible. One of the articles I made use of for this purpose is from Professor Andrew Halestrap, 'Biochemistry: A pore way to die' (2005). Halestrap considers the role of *mitochondria*[85] in the process of cell death. I use details of the research ideas and information presented in this article to help construct a scenario which is designed to work both as a plot device and also to add to the scientific plausibility of the story.

[83] Conversational quote from a meeting with Dr. Russell, Imperial College, 10 June 2011.
[84] Entitled, 'The Pathways of Cell Death: Oncosis, Apoptosis, and Necrosis'.
[85] Mitochondria are considered the powerhouse or chemical energy generators of a cell.

The concepts and 'hard' science within the referenced scientific papers enabled the story of 'The Patient Experiment' to be constructed as it has been, with the character of TP being able to recover comprehensibly from 'cell-death' and so able to be resuscitated *ad infinitum*.

'Popular' Science: In the mainstream press and periodicals there is always a fascination with 'near-death' experiences but occasionally articles do carry some elements of scientific weighting. These pieces were the ones I focussed on to look for possible leads, ideas and further sources of information. For 'The Patient Experiment' one such piece was a 'science-tagged' article by Jonathan Leake (2010) in *The Sunday Times*, 'That's not the afterlife – it's a brainstorm'. This proved particularly useful for the further development of 'TPE' as a science-inspired practice-based research piece, as it deals with oxygen-level driven electrical brain impulses at the point of near-death. Although the reporting is skilfully aimed at a popular audience, in-depth medical and scientific material is included in a description of how brain activity increases rapidly as cells start to die and how this leads to an explosion of electrical energy. Leake hypothesises that this may account for the bright lights and other phenomena in the 'remembering' of NDEs in those patients who survive this experience. The key scientific information in this feature is drawn from the workings of an intensive care doctor, Dr. Lakhmir Chawla from the George Washington University medical centre. He is engaged in using an *EEG* (electroencephalograph) to monitor brain activity in patients who are terminally ill, through to their eventual passing. Unusual brain activity at the point of death was one of his observations. The article by Leake led me in part to re-drafting 'TPE' to include additional plausible story elements as to how and why TP's character can achieve a (fictional) 'reversal' of the death process. In the article there was a quote from a medical scientist, Dr. Sam Parnia from the University of Southampton's School of Medicine[86] which started my thought processes working as to how TP's body could plausibly survive:

> We see death as a moment, but actually it is a process and one which modern medicine can often reverse. Death starts when the heart stops beating, but we can intervene and bring them back to life, sometimes even after 3-4 hours when people are kept cold.
>
> (Parnia in Leake, 2010, p.7)

[86] Coincidentally, Dr Parnia was part of the study into NDEs from 2008, detailed in the 'hard' science section for 'TPE'.

I found the notion that a type of death is potentially reversible after many hours specifically relevant, as this would apply to both TP's (fictional) condition[87] but also to informing plausibility in my story. If my portrayal of TP's resurrection in the fiction contains elements of accepted medical practice, it provides a level of scientific credibility which only enhances the depth of the story I describe.

Once started on the re-write with what I considered a heightened dramatic impact, I continued to research the idea that keeping an injured person's brain (and vital organs) in a colder state than normal would benefit their recovery. I considered what this meant to my character-patient (TP) and his impossible position where in effect he was a willing human guinea-pig, at the behest of the Centre. These ideas were cemented by a 'health issue-facing' article from the same year by Pat Hagan (2010) in the *Daily Mail*, 'Spray to cool brain could save heart attack victims'. In the tabloid piece, two developments in this reportedly 'cold-treatment' emergency approach administered to those suffering a cardiac arrest provided useful detailing. In Hagan's article, two methods are described to help slow down a body's metabolic system through cooling technologies: the first, a medically invasive method of introducing a coolant into the body and circulatory system via an intravenous (IV) line, and second, a portable machine which squirts coolant into the nostrils, as this action apparently cools the brain down rapidly. Although this feature offers mainly surface detail it provided enough information for me to progress the plot (further) along a plausible and dramatic route. I make use of the idea of an artificial coolant system but an external one, much like an oversized freezer. This keeps TP's body in a stable state during his episodes of cardiac arrest, allows his cells to repair themselves (through TP's naturally improved genetic make-up) and so resist succumbing to RI (outlined in the 'hard' science section above).

This 'popular' material became crucial in informing a storyline solution, which helped tie up some of the 'hard' science elements above as to how TP's heart rate and metabolism could be decreased drastically enough for his 'unique' process to kick-start itself.

'A Common Thread': A seasoned anthropological researcher is seconded to a micro-biological project in unusual circumstances and finds that her analytical skills are not the only thing the experimental project requires of her. (Novella.)

The initial idea for this novella comes from an editorial news article in the 'Science and Society' section of the *New Scientist* entitled, 'Discovering the tomb of Jesus, wife and son'

[87] TP's fictional condition is that his body can give the medical impression that he has died but in fact, at a cellular level, TP is still functioning. His recovery *from* death is generated within his own cells. Life spreads out into TP's organs and tissues, and slowly he revives.

(2007). This piece comments on the validity of a recent genetic analysis from mitochondrial DNA[88] identified from the remains of three bodies found in a geographically relevant tomb (which carried the names of Jesus and Mariamne – apparently a term used for Mary Magdalene). It speculates that any possible descendants from Jesus Christ and Mary Magdalene might be able to be traced through Magdalene's mitochondrial DNA. This article and its possible implications intrigued me, and I started to hypothesise on a number of ideas. Could a descendant of Jesus Christ be alive? If there had been descendants and they had lived in modern times, was their DNA accessible or available? Could genetic science be used to extract and create a facsimile of a descendant of Christ, or even Jesus Christ himself?

It occurred to me that if scientists are looking to use mitochondrial DNA from tissues (hair and any skin fragments etc.) to test finds made at ancient historical sites for archaeological purposes, then there is little to stop a well-informed scientist or amateur scientist extrapolating this DNA material (besides moral and ethical concerns) by sequencing the genome from these sample tissues. This thread of a fiction outline was further developed along the lines of an amateur scientist/bio-hacker[89] who excavates (plunders) grave sites of famous and key-historical figures in order to steal their genetic material in an attempt to salvage it, sequence it and catalogue the genome[90]. From a science fiction perspective, there may be an idealised view of replicating historical figures' genomes for less-than altruistic reasons. More immediately my speculative fiction is concerned with learning about genetic traits and features in an attempt to understand personalities and help discover (alongside documented biographical information) what shaped them into the extraordinary people they were.

As my outline progressed the story has been refined into that of Judith Catchpole and her dealings with a synthetic biologist, Professor Charles (her nemesis). Science and genetic science material from both 'hard' and 'popular' science sources are used to help validate the approach and to keep a check on plausibility issues; a selection of which are detailed below.

[88] Mitochondrial Deoxyribonucleic Acid (mtDNA) is DNA that is '…passed on exclusively from mother to child down the maternal line. [Whereas] the Y chromosome…passes only from father to son'. From: a *New Scientist* news article entitled, 'Genes, money and the American quest for identity' by Jessica Marshall (2006).

[89] A type of fictional character (for example, TT) already encountered in 'The Commuter Lab'.

[90] 'A genome is an organism's complete set of genetic instructions. Each genome contains all of the information needed to build that organism and allow it to grow and develop', Wellcome Genome Campus UK (2010).

'Hard' Science: In 'A Common Thread' the most prevalent 'hard' (factual) science is focussed on the extraction of, and subsequent (fictional) re-use of DNA (or at least the genome's codified information) and the processes involved in this.

A *New Scientist* article by Jo Marchant (2011), 'The evolution machine', provides both imaginative inspiration and a 'hard' science consideration of the possible ways in which genetic science will revolutionise the efficiency of processes involved with the genetic engineering of organisms, and what this may lead to in the future. In 'A Common Thread' a similar imaginative approach is used in the fictional design of a prototype machine which is at the heart of the equipment and experimental trials used by Professor Charles in his attempts to synthesise Edmond's facsimile. Designers of the (factual) genetic engineering machine from Marchant's article discuss how they propose to use an artificial evolution process to produce a desired piece of coding that would help solve a particular genetic trait or provide a genetic solution to a known problem. The designers term it 'automated genome engineering' (Marchant, 2011, p.27) and it uses the concept of evolution to help manufacture the required material. The process works on the evolutionary principle that if you engineer enough cells there will eventually be a number of useful variants produced which in turn can be selected and then bred to get the particular trait hoped for.

In my story, the professor aims to reproduce enough traits of natural personality through replicating recovered DNA to help construct a rudimentary persona for the deceased Edmond, and crucially using Judith's genome to provide any broken or missing threads of genetic information. Although the ultimate aims of the designers of the prototype 'evolution machines' in both the factual article and my fiction are different, there are similarities in what the factual scientists are hoping to achieve and what I want my fictional biologist to do. The factual prototype machine in Marchant's article was a good starting place for me in developing what Professor Charles would use.

In addition to the standard areas of genetic engineering and those concerned with forcing genetic evolution by design (as in the Marchant article above), there were specific field-related areas drawn on as content research for this piece. Relevant aspects of the work currently being undertaken by the Virtual Physiological Human Institute (VPHI) for Integrative Biomedical Research[91] proved to be invaluable. The aim of the VPHI (according to their online profile) is to be able to construct each Virtual Physiological Human (VPH) based on a human genome, for collaborative medical and research purposes[92]. This element of factual research

[91] The Virtual Physiological Human Institute (VPHI) for Integrative Biomedical Research is an EU-sponsored research institute whose main aim is to construct real-time medically accurate, software simulated, virtual human models. See VPHI (2011).

[92] For detailed information on the specific modelling of VPH simulations, see VPH-Share (2014).

for my novella is directly linked to the fictional Forensic Science Service (FSS)[93] software and hardware that Judith and Professor Charles 'borrow'. This appropriation is in order for the experimental biologist to try and re-create a synthesised (virtual) version of Judith's ancestor Edmond, from the DNA source he has secured. (See following 'popular' section for information on the source of the sample.)

Although this next consideration is not strictly a 'hard' science issue, one aspect where I did have to find a definitive factual solution was: In which academic discipline would Judith belong to in her capacity as a research assistant? It needed to be in a lightly related field to molecular biology and in an area where there is a crossover, even if it is an unlikely one. By examining different disciplines, the logistics of the story-world required it to be at a cross-section of psychology, biology and anthropology. There is an area of 'biological anthropology' that covers cognition, the physical workings of the brain and central nervous system, and how these all relate to social and cultural situations. There is also one of 'psychological anthropology' which is slightly more leftfield, as it seeks to cover amongst other areas the links between behaviour, thought and mythology within individuals, cultures and communities. Given the personality traits of Judith and what was being asked of her by and within the story, I opted to make her a specialist in 'psychological anthropology' (or 'psych-anth' as she coins it).

'Popular' Science: As well as providing commentary and occasionally speculating (from a 'popular' science perspective) on the many uses for genetic science and synthetic biology, journals such as the *New Scientist* and *Nature* offer useful and informed introductions across a whole range of related scientific subjects. Two examples that I have consulted during the on-going development of my practice-based research are: Cohen (2006), 'Introduction: Genetics', and Michael La Page (2011), 'Read me a genome'.

A key element within the main storyline of 'A Common Thread' is the sample of DNA which Professor Charles obtains in somewhat bizarre and clandestine circumstances. From general research and background knowledge, I was aware that the make-up of a human tooth (enamel hard shell and tissue pulp) would offer a likely chance of being a plausible source of (historic) DNA material. Coupled together with the understanding that extracted healthy teeth (pre-1900s) were seen as a commodity in the form of dentures or individual 'false' teeth, this meant that such items would be likely to be traded and might have survived the last three hundred years (as curios if nothing else). In all, the object of preserved teeth

[93] The Home Office-funded Forensic Science Service (FSS) undertook the duty of providing the logistics of forensic science to the public services in England and Wales. The service was closed down in 2012.

provided a viable source for the DNA sample the professor uses in his experimentations. At the time when I was drafting the initial storyline/s and writing the outlines of the story, I did not consult with any medical or genetic science material concerning the uses of human teeth as the possible repositories of preserved DNA. It was only during the research for another piece (a few years later) that I happened across material that had a direct bearing on the use and preservation of human teeth, which served to validate and confirm the plausibility of this story thread[94]. The two articles which cemented my thoughts concerning the use of preserved teeth were both from the online *BBC News* site. The first concerned the procurement and use of teeth extracted from dead soldiers, beginning at The Battle of Waterloo[95]. The second related to evidence of interbreeding between Neanderthals and early humans[96]. These articles provided details respectively on the use of extracted teeth in early modern dentistry (circa 1800s)[97], and teeth and jawbones as sources of identifying historical DNA.

In a *Sunday Times* feature article by Tim Rayment (2011), 'Do keep up, doctor, this is changing medicine for ever', the language of 'popular' genetic science is used to consider how much of current and near-future medicine will be genetics-based. The article speculates that an increasing need for new techniques and medicines will be part of a synthetic biological revolution. The detail in this article was useful in informing the practice-based research for 'A Common Thread' as general background elements and in the specifics of possible near-future treatments. The author indicates that medical conditions may be treated using a two-part process, initially through the simulation of a person's (fully sequenced) genome and pre-treated on a cellular level to assist the process before any second-stage external or physical medical treatment takes place. In a near-future this might be used much the same as 'gene therapy'[98] is currently used to pave the way for treatments which operate with lower-levels of cellular rejection. As one example, the Rayment article specifies treatments of a small number of cancerous cells which are currently immune to intervention. In a (near-future) two-stage process, these cells may have their genetic make-

[94] See the following section on 'NUCA: Beginnings *in vivo*' (including Fig. 3), as to how this practice of 'checking for science-validity' is built-into the processes I have employed in writing my research-practice material.
[95] 'The dentures made from the teeth of dead soldiers at Waterloo' by Paul Kerley (2015).
[96] 'Modern humans and Neanderthals "interbred in Europe"', *BBC Online News* (2015).
[97] According to a news article in *The Telegraph*, an earlier historical example of the use of extracted teeth as dentures has recently been excavated at an archaeological dig in a Tuscan monastery. Adam Boult (2016) reports that teeth elaborately formed into a dental prosthesis, thought to be from the early 1700s, have been unearthed.
[98] Gene Therapy: 'Is an experimental technique that uses genes to treat or prevent disease.' Quoted description courtesy of Genetics Home Reference (2016).

up slightly altered to make them more receptive to the treatments available. This speculative model provided me with an idea of how the (fictional) professor might embed Judith's DNA within that of Edmond's in order to fill in any gaps which the software identified when preparing for the construction of a complete facsimile of the dead (fictional) physician, to avoid any failures in the replication process.

As a concluding point on the use of 'popular' science material in the creation and validation of 'A Common Thread', an article from the *Sky News* website, 'DNA could create mugshots to snare criminals' (*Sky News Channel*, 2014), provides an interesting new slant that might be applied to my original work. The news piece considers that DNA may soon enable a genetic profiler to use the known effects of 'mutations' or differences, to map out external physical manifestations as facial characteristics to build up an accurate picture of an individual's features. This is a similar function of the fictional machine which Professor Charles acquires from which he aims to create a visual simulation or avatar of Edmond. This news article's commentary on factual science helps provide an element of confirmation that a version of a specific genetic science outcome, as highlighted in my fiction does have a basis in contemporary and plausible science.

As deep background to 'A Common Thread' I was able to align the character of Edmond—the historical relative of Judith (and sample 'donor' of DNA)—with a scientist and physician named Richard Boulton, who was a minor contemporary of Robert Boyle and associated with The Royal Society. Boulton is mentioned in some of The Royal Society's papers but he is most noted for his fascination with the histories of magic and witchcraft. In an article by Michael Hunter (2011) entitled, 'The Royal Society and the decline of magic', Boulton is dismissively described as an author of a publication about magic which The Royal Society tries to distance itself from. For my specific approach, it was important to link the fictional character of Edmond to a (minor) historical scientific figure in order to situate my novella in the world of factual science.

Creative challenges of communicating science in fiction: reflective considerations on editorial choices in creating science-as-fiction (PaR) as effective fiction.

This reflective consideration shows how specific creative challenges in communicating science in fiction are addressed through the writing of science-as-fiction. This is offered in combination with related material presented in Chapters One, Four and Five.

a. Balancing Narrative pace against exposition (including aspects of narrative setting)

'The Commuter Lab' – This fiction is the first piece in the collection (and was the first to be written), and as such, it details a disproportionate amount of the technical aspects of undertaking a genetic science empirical investigation (when considered as a constituent part of the collection). When I was developing the ideas and the use of science behind biologically testing an unsuspecting population, I looked for a situation that would provide cover and anonymity whilst being in an open, densely populated space. The daily London commute in the heart of the West End provided a perfect situation. Few commuters would notice or question an official-looking authoritative figure such as Professor Randall and most people would avoid contact with a chugger. Both characters are plausible to have in and around a commuting train station and would not look out of place.

Due to its plot structure, 'The Commuter Lab' narrative begins in the middle of two concurrent events (strands) that happen at the same point in time. Professor Randall is in the process of undertaking a covert field experiment while Peter is trying to half-heartedly legally obtain financial details for whatever is that week's 'good cause'. The ability to cross-cut between narrative strands enables me to balance the pace of Randall's practised routine of collecting biological samples with that of Peter's unrehearsed, ungainly attempts at obtaining commuter's bank details. The chance connection that brings the two narrative strands together—and the two characters face-to-face—is the detail that Peter has biological scientific training from his degree courses. He recognises a field experiment and seemingly what the professor is up to. Against his better judgement but bored and curious, he confronts the professor with questions that lead eventually to the scuffle and the chain of events that will ultimately lead to Peter's scientific discovery but also, in due course, his own death.

Enabling a plot framework of two distinct narrative strands—the professor, Amy and the world of covert scientific operations in Moorfields, and Peter and TT, the world of the garage-hacker and amateur science in Southgate—that are connected both by an event and physically (through electronic means), provides opportunities to show the scientific processes of discovery and the application of that discovery from both the perspective of (amateur) scientists not knowing what they have, and the professional scientists who have created the organism and know exactly what its potential is. In addition to being able to present and cut between two opposing (scientific) ideologies, a twin-strand narrative approach enables the discussion of scientific discourse and exposition across a range of characters and a range of perspectives, knowledge and experience. This helps to spread out both the 'discovery' elements and the integration of the genetic testing processes present in the conversations between Peter and TT, and the advanced biotechnology testing

procedures, safety protocols and risk assessment material covered within the discourse of the Lizard Street HQ. Through this integration, issues of didacticism that can be present in science-as-fiction are alleviated, so the exposition seems neither out of place or inappropriately handled.

Exploring between pp.36-43, the narrative pace is determined directly by the type and detail of exposition that is being teased out in 'The Garage' and monitored and responded to—in conjunction with an emergency regulatory body, The Network—by Amy in the Lizard Street HQ. It was determined that after an early frenetic pace, the denouement of this narrative would be played out (mainly) across two connected and fixed locations. This decision was driven by the method of delivery of the scientific detail and exposition required to bring the piece to the desired conclusion. The effectiveness lies in the two isolated locations, linked only by a data stream. It underlines the situation Peter and TT find themselves in – no-one is coming to help them or to save them. They have been banished from the scientific community and accidentally, sentenced to death. Amy looks on with some regret that she cannot aid them but for her, state security must come first and driven by this, she cuts the hackers loose to fend for themselves. The science of the biotechnology that Professor Randall and Dr. Hawkes have been developing needs to be kept as a covert operation, and for now this is her only consideration.

'The Patient Experiment' – In comparison to 'The Commuter Lab', this piece builds up its narrative pace deliberately along a single strand, as exposition is revealed through a variety of sources – journal research, patient case notes, hearsay, conversations with Nurse Arthurs, Sister O'Rourke and the patient himself, TP. Scientific (along with social, moral and ethical) discourse is revealed in a piecemeal method, that is only allowed to come together as the narrative moves swiftly towards its closing stages. The build-up, along with the slow reveal of exposition was an intended narrative device, as the main character of Jake starts his new role, he is still in a depressed, recovering state. The narrative pace allows Jake to be subtly drawn into a story-world where it is clear, he was always intended to be the fall guy or 'patsy'. In designing the delivery of the narrative, I wished it to be a slow, methodical, institutionalised (almost gothic) set-up, where a lost soul could be enticed to follow his true nature and deliver the completion that was required. Somewhat influenced by Kafka's *The Trial* (1925) and *The Castle* (1926), this narrative in contemporary Oxford, brings together a mysterious authority who has ultimate control, and where redemption and resolution are only available to those willing to risk the ultimate sacrifice.

The structure of the plot is designed to pull Jake in competing directions (mainly steered by Sister O'Rourke) to make him more malleable. Looking across the outline framework Jake is manipulated from the moment he accepts the job: He is given a cool reception; shown to a basement office; left to his own devices; misled by his patient; obstructed by Sister; not given crucial information; introduced into a shocking situation without real preparation; marginalised, and then put in an impossible position, of which there is only one choice he can make. The framework allows Jake to spend long periods contemplating work and specifically, TP. This occupies his thoughts. He uncovers elements of scientific discourse through reading case notes and journals that enable him to piece together his findings. This method of 'delivering' exposition in this style seems less awkward than in a conversational back and fro method—although those approaches are used too—and works with the character of Jake as he is introspective by nature, so enjoys debating with himself and puzzle-solving. A fair amount of the exposition relies on the written word, read by Jake and picked over in his mind. This helps him formulate the questions and requests for information that he needs to ask and ask of, Sister, Nurse Arthurs and TP.

One of the most intense and dramatic scenes that results in detailed scientific discourse including questions of medical ethics happens when Jake is called into theatre in the early hours, to witness TP's recovery process in frank and shocking detail. Between pp.67-73, Jake is contacted by telephone and he rushes into the Centre, to be greeted by TP in critical condition and Sister O'Rourke holding court, directing procedures in theatre. I designed this to be a pivotal point in the narrative where Jake resolves to help TP escape this 'torture'. Unknown to Jake, the scene is stage-managed to assist him to arrive at this conclusion – TP is truly critical, but Sister takes control of what Jake can see and the information he receives. The narrative pace increases from the level it has been at in previous pages (scenes) from the moment when Jake picks up the phone. The pace is planned for urgency, both in the action happening in theatre and in the exposition that is delivered from Sister to Jake against the backdrop of TP seemingly fighting for his life. It is a dramatic scene and heightened through Sister O'Rourke's willingness to tell Jake exactly what is happening and why it is happening, when before she was reticent to do so. Sister draws Jake in as she explains that TP's cells are different, that they can keep a certain level of oxygen in them when the circulatory system has temporarily ceased to function and so, resist 'cell death'. Jake questions this and they begin a heated and frenetic discussion in which the necessary exposition sits efficiently without seeming forced or didactic in nature. The stakes are raised, and the tension increases as Sister starts to divulge that TP has a genetic condition that enables his body (specifically his cells) to function in this way. The core of this discourse is the theory and concept of

'Reperfusion Injury' (see earlier notes on this contemporary area of research and medical phenomena) and the use of (oxygen) free radicals that are the key to TP's system maintaining integrity during a stroke or heart attack. The discussion that follows helps Jake understand exactly what is happening to TP and begins to explain his recent deterioration, from which TP fears and Jake now knows, there is no coming back from. In theatre, TP stabilises, and the narrative pace slows along with the discourse. Sister draws things to a close for Jake and leaves him with more than just thoughts to ponder on, as she says, 'Best leave TP in our capable hands for now. When he's recovered, we'll leave him in yours' (p.73).

'A Common Thread' – When Professor Charles rudely interrupts Judith and they embark on their journey from the Kent coast to retrieve genetic analysis equipment from the FSS HQ in Southwark, the plot structure begins from a point of scientific hypothesis—can historic genetic material provide the source code to re-create a virtual persona of a long-dead figure—and completes (in the English Lake District) with the first successful signs of a breakthrough in bringing those concepts and ideas to fruition, as Judith nurtures the virtual persona of her ancestor, Edmond. The framework to deliver Judith into a narrative situation where she can influence (and perhaps dictate) the outcome is devised so she must overcome both personal challenges—while Judith is content with mild unhappiness, her frustration is kept in check through her working relationship with Professor Eustace but her quick-temper can sometimes vent that frustration—and professional ones. By her nature, Judith is confrontational and place her together in an unfamiliar surrounding with an authoritative character such as Professor Charles, results in moments of increased tension and flashpoints, as they stubbornly confront each other. Through the plotting of set-pieces—Judith's front door, road-trip, FSS HQ, Judith's house, University laboratory and work room and the hospital A&E—and organising the narrative structure so the majority of the action, character interaction, scientific discourse and exposition takes place in these set-ups, the character of Judith finds herself exposed in unfamiliar environments, and this brings out her combative side. The increased narrative pace that operates in parallel with confrontation enables and encourages the delivery of detailed exposition within these bouts of tension between the two characters of Judith and the professor. The heated level of scientific (and moral and ethical) discourse is designed to resemble a 'rush to the top' that delivers social and scientific ideas, concepts and detail which results in a momentary flashpoint after which the information slowly percolates and permeates through and is digested in the aftermath.

The passage between pp.121-4 provides an opportunity to consider how narrative pace and exposition (and scientific discourse) can be closely aligned, where an increase in one

aspect can facilitate an increase in the rate—acceleration—of the other. As an illustration in the design of achieving an operational balance between narrative pace and exposition in 'A Common Thread', this interaction between Judith and Professor Charles displays an effective positioning of scientific and historic exposition that reveals why Judith has been chosen to assist the professor, and why her own self—her genetic make-up—is of vital importance to him. As an acceleration in the level, detail and narrative importance of the exposition takes place, there is a simultaneous increase in the pace of the narrative that markedly assists in progressing the plot towards a point of resolution. In the passage, Judith has managed to stabilise her anger at being a pawn in somebody else's game. (As a reader) we see her trying to rationalise her position, as she believes in the concept of what she thinks the professor is engaged in. Judith can understand that it is potentially very important scientific research and wants to give him the benefit of the doubt. The professor starts to explain, through contextualised exposition, that his attempts to stabilise Edmond's presence have been limited. He suspects there is missing code, or the code has become inactive in the sample he has. Judith listens, increasingly agitated and wonders where this is leading. The professor talks about using an infusion of new code to bring any inactive code back to life. She now realises why she is there and why she has been seconded to work on the project. A heated exchange happens, and this pushes Judith over the edge. The initial exposition and then exchange moves the narrative on at an increased pace, and as a result of the storyline over the next few pages, the narrative is set on course for its resolution.

As a departure from the two earlier novelettes in the collection, the narrative viewpoint in this novella is more closely aligned with the main character and is written in the first-person. This choice was made as the narrative deals with a subject matter that requires a direct personal input from a subjective perspective. The scientific discourse discusses the possibility of merging a piece of genetic code with that of an ancestor, to re-create that ancestor. Even in a virtual environment this needs to be considered from the perspective of how a character would feel about this proposition, and for this reason, I decided to explore a first-person choice for the narrative viewpoint. I wanted to explore the emotions and thoughts of being asked to make such a decision. The most direct way—without side-stepping into fantasy or the science fiction of Dick—was to experience the notion, through the eyes and thoughts of Judith. In taking this perspective, discussions of scientific discourse and details of the necessary exposition could be mitigated through Judith as she processed and digested them, and then explored both the wonder of what she was being asked to believe in along with the ramifications of what was being proposed, and then demonstrated before her eyes. In a narrative sense, Judith mediates the exposition of 'raw' science and scientific discourse and

delivers her thoughts directly to the reader. As indicated above, this blocked delivery of information rather than that of a steady drip, presents a narrative pace that while it mirrors periods of exposition does create a framework that has accelerated peaks and measured troughs, and presents elements of a staccato or episodic plot structure, within the main story arc.

b. Challenges of using dialogue to provide scientific information

Dialogue is an effective method of communicating scientific information, whether it is through 'informing', 'telling' or 'showing' (exposition) or a conversational discussion or question-and-answer format (discourse). A key challenge in my collection—along with that of accuracy—is to provide credible dialogue that is neither stilted through technical detail nor overblown with ideas and concepts. When characters are talking about a concept or procedure or idea through exposition or when two characters are discussing a scientific idea or process through discourse, it is often a balancing act to provide the information that is needed for the narrative to progress and the characters to act on the information that they are privileged to, and for my pieces—in this collection—to appear as naturalistic as possible. As I am writing in a contemporary setting, I am not looking to produce dialogue that aims to establish a fantasy or science fiction world, where heightened reality or a peculiar dialect is purposefully used to institute difference, such as Mieville's *The City and The City* so effectively achieves. My science-as-fiction collection, though speculative, is designed to be naturalistic in nature and creating relevant, suitable and readable dialogue is a major component of this.

As the novelettes and novella in my research practice collection have undergone numerous re-writes and re-drafting, the issues I initially had with creating and then editing the dialogue passages and exchanges in all three pieces—and more so with 'The Commuter Lab' as the first piece written—were many and varied. With this initial fiction, as I began to try to interpret my scientific and academic research into a narrative piece of work, I first had to be certain that I understood the science and technological detail that I would then try to put into the minds and mouths of my characters. From the initial plot framework, in which I mapped out when particular events in the narrative would take place and which of the characters would be involved, I then refined this into scenes. As I was not engaged in writing a novel and did not have the luxury of a chapter framework to rely on, working with scenes provided a reliable alternative. Once I had the scenes plotted, I began to start on creating dialogue. I hit a stumbling block early on with my attempts to introduce portions of (interpreted) scientific information into the characters' speech and conversation through

exposition and discourse, respectively. This aspect is key to successfully producing any science-as-fiction and especially that aimed at a general readership. I did struggle with creating effective dialogue across all three pieces, but I was able to learn both as I went from one piece to the next, and then each time as I returned to revise or edit the text and the dialogue. This continues to be a learning curve, and now I find I am able to start each new fiction further on that curve. (For an applied consideration of the practical challenges in using dialogue to convey scientific information, see Appendix (v).)

c. Character development

As constituent parts of Chapters Two, Four and Five, I have examined aspects of character development in my practice collection and reflected both on their construction and their role/s in the fiction. A selection of this is presented to link directly into discussions and reflections on the creative practice offered as a key component in my research study.

When designing and developing characters for the fiction in my research collection, I consider how to deliver a character that is believable, in parts empathetic (the level of this depends on how they are utilised in the narrative), is likeable or could be identified with (for the main roles), has the required level of scientific understanding appropriate for their role, and for the most part, has a sense of humour.

I consider whether a (main) character, either through actions or thoughts, thinks about how the science they are involved with, impacts on the society they exist in. This means that they would need to be aware of the (story-)world around them to have a conscience about what they are engaging with (i.e. they appear to be sentient). This returns to my earlier point about a character being 'believable' for both narrative purposes and to a reader.

I aim to create characters who are scientifically literate (or least, receptive to possibilities), that are interesting, quirky and avoid the usual science-based clichés of being self-centred, reckless and obsessive (where possible). For a main character, I look to have them stand out but not necessarily be wholly decent—though they should exhibit some empathetic draw—and be intriguing to a reader.

Detailed consideration is given to the question: What do my characters scientifically 'bring to the table' within the fiction? Through asking this, I can equip each character with the appropriate scientific credibility and make sure that each has the correct knowledge to be convincing in their role.

Closing Chapter Statement

I know it was (and still is) a topic of educational debate, but at the beginning of my research process I was tentative at the prospect of creative practice being considered as research. From the perspective of now having completed that practice, I can appreciate that research is rooted as much in the process, as on the focused outcome. In terms of referring to practice-based writing as 'knowledge' and 'research', I feel confident that my practice has critically informed how a factually inspired genetic science work of fiction is developed, designed and written.

CONCLUSION

Reflecting on this project, my perspective is from the beginning of a journey rather than at its end. The structure of a creative research study brought a certain freedom to producing work which crossed boundaries between academic theory and practice. When considering the approach I should take with the contextual rationale it became clear that it would be challenging to bring together the needs of a more theory-based methodology with those of a creative practice activity to help explain what my research project was, what I wanted to achieve and whether I felt that it had been successful.

Through my research approach I have been able to address complex issues of form and genre in creative practice. There was always a balance to be reached between what I wanted to say with my fiction (critical reception) and what I wanted to say in my fiction (creative reception). The choices I made both in the communication of scientific material and the design of the characters and their stories, enabled me to create a critically facing collection of science-as-fiction set in contemporary society within a speculative framework, all bound together by (genetic) science. My practice sits solidly in a speculative fiction category that occupies a middle-ground between the broad groupings of literary and genre fiction and slips (on occasion) into social science fiction.

In this doctoral thesis, science-inspired writing explores and situates the processes of science and genetic science through contemporary fiction, in an informed mix of the possible and the probable. It is through this dual-approach (and is evident in the resulting critical study) that the strength of my ideas, subject-research and applied practice all combine to produce a collection of work that offers a distinctive methodology in the use of science-based characters and scientific material, in creating a selection of contemporary speculative fiction.

END

BIBLIOGRAPHY

Adams, K. (2017) *The different types of fiction in a way that won't make your head explode* [online]. Available at: https://www.writerscookbook.com/different-types-of-fiction/ [Accessed 10 October 2018].

Ashenhurst, J. (2010) *In Summary: Free Radicals* [online]. Master Organic Chemistry. Available at: http://www.masterorganicchemistry.com/2013/12/09/in-summary-free-radicals/ [Accessed 4 January 2014].

Ashbrook, T. (2017) 'A Gene Editing Breakthrough'. *Center for Genetics and Society* [online]. 8 August 2017. Available at: https://www.geneticsandsociety.org/article/gene-editing-breakthrough [Accessed 11 August 2017].

Atwood, M. (1996) [1985] *The Handmaid's Tale*. London: Vintage.

Atwood, M. (2005) 'Aliens have taken the place of angels: Margaret Atwood on why we need science fiction'. *The Guardian: Film* [online]. 17 June 2005**.** Available at: https://www.theguardian.com/film/2005/jun/17/sciencefictionfantasyandhorror.margaretatwood [Accessed 20 June 2017].

BBC News Channel (2005) *Deadly fungus gene code cracked* [online]. BBC News. 22 December 2005. Available at: http://www.bbc.co.uk/1/hi/health/4546704.stm [Accessed 20 July 2009].

BBC Online News (2015) *Modern humans and Neanderthals 'interbred in Europe'* [online]. BBC News: Science & Environment editorial. 22 June 2015, pp.1-7. Available at: http://www.bbc.co.uk/news/science-environment-33226416 [Accessed 23 June 2016].

BBC Radio 4 (2018) *Free Radicals* [online]. BBC Radio 4: In Our Time. 1 November 2018. Available at: https://www.bbc.co.uk/programmes/m0000xqd [Accessed 1 November 2018].

Balchin, N. (1949) *A Sort of Traitors*. London: Collins.

Barrett, A. (1996) *Ship Fever*. New York: W.W. Norton & Company.

Barrett, A. (2013) *Archangel*. New York: W.W. Norton & Company.

Baugh, C. (2012) 'Research Assessment and Practice as Research (PaR)'. *University of Winchester, Faculty of Arts Research Seminar Series* [online]. 22 February 2012**.** Available at: http://www.winchester.ac.uk/research/attheuniversity/facultyofarts/Documents/C%20Baugh.ppt. [Accessed 26 July 2017].

Beer, G. (1983) *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction*. London: ARK Paperbacks.

Bould, M., Butler, A.M., Roberts, A. and Vint, S. (eds.) (2009) *The Routledge Companion to Science Fiction*. London: Routledge.

Boult, A. (2016) '400-year-old dentures made from human teeth unearthed by archaeologists'. *The Telegraph: News* [online]. 21 November 2016. Available at: http://www.telegraph.co.uk/news/2016/11/21/400-year-old-dentures-made-human-teeth-unearthed-archaeologists/ [Accessed 22 November 2016].

Boulter, A. (2007) *Writing Fiction: Creative and Critical Approaches*. Basingstoke, UK: Palgrave Macmillan.

Boyd, W. (1990) *Brazzaville Beach*. London: Penguin Books.

Boyd, W. (2009) *Ordinary Thunderstorms*. London: Bloomsbury Publishing.

Bradbury, R. (1999) [1953] *Fahrenheit 451*. London: Flamingo Modern Classics.

Brennicke, A. (2009) 'Seedy Dealings'. *Lablit.com: Fiction Archive* [online]. Available at: http://www.lablit.com/article/478 [Accessed 6 March 2015].

Brewer, P. R. and Ley, B. L. (2010) 'Media Use and Public Perceptions of DNA Evidence'. *Science Communication*. **32** (1), pp.93-117.

Brier, S. (2006) 'Ficta: Remixing generalized symbolic media in the new scientific novel'. *Public Understanding of Science*. **15** (2), pp.153-174.

Burroway, J. (2007) *Imaginative Writing: The Elements of Craft*. 2nd ed. New York: Penguin Academics (Pearson Longman).

Burroway, J. and Stuckey-French, E. (2007) *Writing Fiction: A Guide to Narrative Craft*. 7th ed. New York: Pearson Longman.

Byers, M. (2004) *Long for This World*. New York: Mariner Books.

Byers, M. (2010) *Percival's Planet*. New York: Henry Holt & Company.

Cadwalladr, C. (2005) *The Family Tree*. London: Doubleday.

Cadwalladr, C. and Graham-Harrison, E. (2018) 'Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach'. *The Guardian* [online]. 17 March 2018. Available at: https://www.theguardian.com/news/2018/mar/17/cambridge-analytica-facebook-influence-us-election?CMP=share_btn_link [Accessed 24 March 2018].

Chabon, M. (2000) *The Amazing Adventures of Kavalier and Clay*. London: Fourth Estate.

Chevalier, T. (2009) *Remarkable Creatures*. London: HarperCollins.

Chouchani, E.T. *et al*. (2014) 'Ischaemic accumulation of succinate controls reperfusion injury through mitochondrial ROS'. *Nature*. 515 (7527), p.431-435. DOI:10.1038/nature13909. Available at: http://www.nature.com/nature/journal/v515/n7527/full/nature13909.html [Accessed 7 December 2014].

Chown, M. (2008) 'Sci-fi special: is science fiction dying?'. *New Scientist*, No. 2682, p.46.

Cohen, P. (2006) 'Introduction: Genetics'. *New Scientist* [online]. Daily news, 4 September 2006, p.1. Available at: https://www.newscientist.com/article/dn9964-introduction-genetics/ [Accessed 23 March 2011].

Collins, H. and Pinch, T. (1998) *The Golem: What You Should Know about Science*. 2nd ed. Cambridge: Cambridge University Press.

Collins, S. (2008) *The Hunger Games*. New York: Scholastic Corporation.

Cook, E.W., Greyson, B. and Stevenson, I. (1998) 'Do any Near-Death Experiences provide evidence for the survival of human personality after death?'. *Journal of Scientific Exploration*. **12** (3), pp.377-406.

Crichton, M. (1969) *The Andromeda Strain*. London: Jonathan Cape.

Crichton, M. (1991) *Jurassic Park*. London: Arrow Books.

Crichton, M. (2002) *Prey*. London: HarperCollins.

Crichton, M. (2004) *State of Fear*. London: HarperCollins.

Darwin, C. (2008) [1859] *On the Origin of Species*. Oxford: Oxford University Press.

Dick, P.K. (1999) [1968] *Do Androids Dream of Electric Sheep?* London: Millennium.

Dick, P.K. (2001) [1962] *The Man in the High Castle*. London: Penguin Classics.

Dick, P.K. (2003) [1974] *Flow My Tears, The Policeman Said*. London: Gollancz.

Djerassi, C. (1989) *Cantor's Dilemma*. New York: Doubleday.

Docx, E. (2011) *The Devil's Garden*. London: Picador.

Dolomite Microfluids (2008) *Microfluids to revolutionise DNA analysis* [online]. Laboratorytalk. Available at: www.laboratorytalk.com/news/dol/dol110./html [Accessed 7 July 2009].

Doyen, E. (2012) *Novel Writing: Imagination on the Page*. London: Creative Commons.

Driver, R., Leach, J., Millar, R. and Scott, P. (1999) 'Perspectives on the nature of science'. In: Scanlon, E., Hill, R. and Junker, K. (eds.) *Communicating Science: Professional Contexts*. London: Routledge, pp.4-26.

Durham University (2008) *Centre for Death and Life Studies* [online]. Durham University. Available at: https://www.dur.ac.uk/cdals/ [Accessed 6 April 2010].

Eco, U. (2004) [1983] *The Name of the Rose*. London: Vintage.

Edwards, W.H. (2004) [1847] *A Voyage up the River Amazon*. Wyoming, USA: The Narrative Press.

Eliot, G. (2008) [1871] *Middlemarch*. New York: Quill Pen Classics.

Evans, A.B. (2009) 'Nineteenth-Century SF'. In: Bould, M., Butler, A.M., Roberts, A. and Vint, S. (eds.) *The Routledge Companion to Science Fiction*. London: Routledge, pp.13-22.

Fisher, J.A. and Cottingham, M.D. (2016) 'This isn't going to end well: fictional representations of medical research in television and film'. *Public Understanding of Science* [online]. Research Paper published online, pp.1-15. DOI: 10.1177/0963662516641339. Available at: http://pus.sagepub.com/content/early/2016/04/04/0963662516641339.abstract [Accessed 6 April 2016].

Fitzgerald, S.A. (2015) 'The Nature of Transitory Disappearance: Dom's Tale'. *Thursday Identity*. Available at: https://splendidfred.wordpress.com/2015/02/20/the-nature-of-transitory-disappearance/ [Accessed: 20 February 2015].

Fitzgerald, S.A. (2018) 'Writing genetic science-inspired fiction in contemporary society', PhD Thesis, The University of Winchester, Winchester, UK.

Fitzgerald, S.Z. (2016) 'NUCA: A beginning *in vivo*'. *Holdfast Magazine*. Available at: http://www.holdfastmagazine.com/nuca-brexitlit/4592952439 [Accessed: 11 September 2016].

Fitzgerald, S.Z. (2016b) 'The Nature of Transitory Disappearance: Bella's Tale'. *The Honest Ulsterman* Available at: http://humag.co/prose/the-nature-of-transitory-disappearance-bella-s-tale [Accessed: 10 October 2016].

Fitzgerald, S.Z. (2016c) 'Using the creation of genetic fiction to examine practice-based research in creative writing: a consideration of methodology'. Paper presented at: *Writing Between the Lines: A Postgraduate Symposium Exploring Creative Writing as a Research Methodology*. Cardiff School of Education, Cardiff Metropolitan University, Wales, UK, 1 Sept 2016. [s.n.]

Fitzgerald, S.Z. (2017) *Published Writing: Fiction*. Creative practice website. Available at: http://www.seanzfitzgerald.com [Accessed: 12 January 2018].

Frayling, C. (1993/4) 'Research in Art and Design'. *RCA Research Papers*. Vol. 1 No. 1. London: Royal College of Art. Available at: http://researchonline.rca.ac.uk/384/3/frayling_research_in_art_and_design_1993.pdf [Accessed: 14 October 2018].

Frayling, C. (2005) *Mad, Bad and Dangerous?: The Scientist and the Cinema*. London: Reaktion Books Ltd.

Fuller, S. and Junker, K. (1998) 'Beyond the "Science Wars"'. *Science and the Public*. S802: Part C Dialogues. Milton Keynes, UK: The Open University, p.6. (Open University MSc Science course material.)

Gaines, S. (2001) 'Sex, love and science', *Nature*. **413** (6853), p.255.

Gaines, S.M. (2000) *Carbon Dreams*. Berkeley, California: Creative Arts Book Company.

Gaines, S.M. (2011) 'Fiction Meets Science'. Unpublished working document. Bremen: University of Bremen.

Gaines, S.M., Kirchhofer, A., Schaffeld, N., Schimank, U. and Weingart, P. (2013) 'Fiction Meets Science: Background and Concept'. In: *Fiction Meets Science Concept Paper 1* [online]. Bremen: University of Bremen, August 2013. Available at: http://www.fictionmeetsscience.org/ccm/cms-service/stream/asset/?asset_id=1133006 [Accessed 30 October 2013].

Gardner, J. (1991) *The Art of Fiction: Notes on Craft for Young Writers*. New York: Vintage Books.

Genetics Home Reference (2016) *What is gene therapy?* [online]. NIH: U.S. National Library of Medicine. Available at: https://ghr.nlm.nih.gov/primer/therapy/genetherapy [Accessed 2 August 2016].

Ghosh, J. (2008) 'A Quick Spin'. *Lablit.com: Fiction Archive* [online]. Available at: http://www.lablit.com/article/412 [Accessed 6 March 2015].

Goldacre, B. (2008) *Bad Science*. London: Fourth Estate.

Goldschmidt, P. (2015) 'An investigation into love by Babcock and Wainwright'. *Lablit.com: Fiction Archive* [online]. Available at: http://www.lablit.com/article/856 [Accessed 6 March 2015].

Goodman, A. (2009) *Intuition*. London: Atlantic Books.

Gordon, R. (2009) 'Learning from fiction: applications in emerging technologies'. *Bulletin of Science, Technology & Society*. **29** (6), pp.470-5.

Graham, R. (2007) *How To Write Fiction (And Think About It)*. Basingstoke, UK: Palgrave Macmillan.

Gregory, J. and Miller, S. (1998) *Science in Public: Communication, Culture, and Credibility*. New York: Plenum Trade.

Hagan, P. (2010) 'Spray to cool brain could save heart attack victims'. *Daily Mail*. 19 October 2010, p.38.

Halestrap, A. (2005) 'Biochemistry: a pore way to die'. *Nature*. **434** (7033), pp.578-9.

Hanse-Wissenschaftskolleg (Hanse Institute for Advanced Study) (2014) *Fiction Meets Science – The World of Science under the Literary Microscope* [online]. Bremen: University of Bremen, November 2014. Available at: http://www.fictionmeetsscience.org/ccm/content/news-and-events/events/2014-conference-agenda/ [Accessed 14 June 2016].

Hardy, T. (1993) [1891] *Tess of the d'Urbervilles*. Hertfordshire, UK: Wordsworth Editions.

Harrison, N. and Kincaid, P. (2010) *The State of British Science Fiction and Fantasy: Twenty Years and Two Surveys*. Hertfordshire, UK: Odd Two Out/British Science Fiction Association.

Haynes, R.D. (1994) *From Faust to Strangelove: Representations of the Scientist in Western Literature.* London: John Hopkins Press Ltd.

Haynes, R.D. (2003) 'From Alchemy to artificial Intelligence: stereotypes of the scientist in western literature'. *Public Understanding of Science*. **12** (3), pp.243-253.

Haynes, R.D. (2014) 'Whatever happened to the 'mad, bad' scientist? Overturning the stereotype'. *Public Understanding of Science* [online]. Published online before print, 10 June 2014, pp.1-14. DOI: 10.1177/0963662514535689. Available at: http://pus.sagepub.com/content/early/2014/05/30/0963662514535689 [Accessed 11 June 2014].

Haynes, R.D. (2016) 'Whatever happened to the 'mad, bad' scientist? Overturning the stereotype'. *Public Understanding of Science*. **25** (1), pp.31-44.

Horizon Research Foundation (2007) *Science at the Horizon of life* [online]. Horizon Research Foundation. Available at: http://www.horizonresearch.org/ [Accessed 6 April 2010].

Horizon Research Foundation (2008) *Implications for the Care of Patients* [online]. Horizon Research Foundation. Available at: http://www.horizonresearch.org/patient-caregive/implications-for-the-care-of-patients/ [Accessed 6 April 2010].

Horizon Research Foundation (2008b) *Post Resuscitation Care* [online]. Horizon Research Foundation. Available at: http://www.horizonresearch.org/for-professionals/post-resuscitation-care/ [Accessed 6 April 2010].

Horizon Research Foundation (2008c) *The Human Consciousness Project* [online]. Horizon Research Foundation. Available at: http://www.horizonresearch.org/research-zone/human-consciousness-project/ [Accessed 6 April 2010].

Horizon Research Foundation (2009) *Exploring the science of what happens when we die* [online]. Horizon Research Foundation. Available at:

http://www.horizonresearch.org/main_page.php/page/3/?cat_id=79 [Accessed 6 April 2010].

Hunter, M. (2011) 'The Royal Society and the decline of magic'. *Notes and Records: The Royal Society Journal of the History of Science* [online]. **65** (2), pp.103-119. Available at: http://rsnr.royalsocietypublishing.org/content/65/2/103 [Accessed 7 August 2011].

Ishiguro, K. (2005) *Never Let Me Go*. London: Faber and Faber.

Kafka, F. (2009) [1925] *The Trial*. Oxford: OUP.

Kafka, F. (2009) [1926] *The Castle*. Oxford: OUP.

Keen, S. (2003) *Narrative Form*. Basingstoke, UK: Palgrave Macmillan.

Kelty, C. M. (2010) 'Outlaw, hackers, Victorian amateurs: diagnosing public participation in the life sciences today'. *Journal of Science Communication* [online]. **09** (1), pp.1-8. Available at: http://jcom.sissa.it/archive/09/01/Jcom0901(2010)C01/Jcom0901(2010)C03 [Accessed 14 April 2010].

Kerley, P. (2015) *The dentures made from the teeth of dead soldiers at Waterloo* [online]. BBC News Magazine. 16 June 2015, pp.1-10. Available at: http://www.bbc.co.uk/news/magazine-33085031 [Accessed 19 June 2015].

Kingsley, C. (1995) [1863] *The Water Babies*. London: Penguin Books.

Kirby, D.A. (2003) 'Scientists on the set: science consultants and the communication of science in visual fiction'. *Public Understanding of Science*. **12** (3), pp.261-278.

Kuhn, T. (1962) *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

La Page, M. (2011) 'Read me a genome'. *New Scientist* [online]. Daily news, 16 February 2011. Available at: http://www.newscientist.com/article/dn20137-read-me-a-genome.html#.VRRBS47-XhI [Accessed 23 March 2011].

Laboratorytalk (2008) *Microfluidics to revolutionise DNA analysis* [online]. UK: Synthesis Media. Available at: http://labtalk.evoluted.net/category/archive/77/page:10 [Accessed 7 July 2009].

Lambourne, R. (1999) Science fiction and the communication of science. In: Scanlon, E., Whitelegg, E. and Yates, S. (Eds) Communicating science: contexts and channels. London: Routledge.

Lasky, K. (2013) 'Poetics and Creative Writing Research'. In: Kroll, J. and Harper, G. (Eds) *Research Methods in Creative Writing*. Hampshire, UK: Palgrave Macmillan.

Latour, B. (1987) *Science in action: how to follow scientists and engineers through society*. Cambridge, Massachusetts: Harvard University Press.

Le Guin, U.K. (1969) *The Left Hand of Darkness*. New York: Ace Books.

Leake, J. (2010) 'That's not the afterlife – it's a brainstorm'. *The Sunday Times*. 30 May 2010, p.7.

Ledford, H. (2016) 'CRISPR: gene editing is just the beginning'. *Nature* [online]. **531** (7593), pp.156-9. Available at: http://www.nature.com/news/crispr-gene-editing-is-just-the-beginning-1.19510 [Accessed 22/07/16].

Lethem, J. (1998) *As She Climbed Across the Table*. New York: Vintage Books.

McCabe, J. (1999) *Paper*. London: Granta Books.

McCabe, J. (2001) *Snakeskin*. London: Granta Books.

McEwan, I. (1997) *Enduring Love*. London: Jonathan Cape.

McEwan, I. (2005) *Saturday*. London: Jonathan Cape.

McEwan, I. (2010) *Solar*. London: Jonathan Cape.

McKenna, P. (2009) 'Rise of the garage genome hackers'. *New Scientist*. No. 2689, pp.20-1.

McLachlan, H. (2009) 'Do you believe in miracles?'. *New Scientist*. No. 2730, pp.26-7.

Macilwain, C. (1997) 'Campuses ring to a stormy clash over truth and reason'. *Nature*. **387** (6631), p.331-333.

Marchant, J. (2011) 'The Evolution Machine'. *New Scientist*. No. 2818, pp.34-9.

Marshall, J. (2006) 'Genes, money and the American quest for identity'. *New Scientist* [online]. No. 2542, pp.10-11. Available at: https://www.newscientist.com/article/dn8832-genes-money-and-the-american-quest-for-identity/ [Accessed 23 March 2011].

Marshall, R.P. (2013) *Antisense*. N Charleston, South Carolina: CreateSpace Independent Publishing Platform.

Mawer, S. (1997) *Mendel's Dwarf*. London: Doubleday-Transworld Publishers Ltd.

Mawer, S. (2003) 'DNA and the meaning of life'. *Nature Genetics*. **33** (April), pp.453-4.

Mawer, S. (2005) 'Science in Literature: Interview'. *Nature*. **434** (7031), pp.297-9.

Mawer, S. (2015) *Tightrope*. London: Little, Brown Book Group.

Mirchandani, A. (2015) *The Original Frankenfoods: Origins of Our Fear of Genetic Engineering* [online]. Genetic Literacy Project. Available at: https://www.geneticliteracyproject.org/2015/02/10/the-original-frankenfoods [Accessed 25 May 2016].

Mieville, C. (2000) *Perdido Street Station*. New York: Ballantine Publishing Group.

Mieville, C. (2009) *The City and the City*. London: Pan Macmillan.

Motluk, A. (2009) 'Occupation: lab rat'. *New Scientist*. No. 2718, pp.41-3.

NHS Choices (2015) *Vaccinations: MMR Vaccine* [online]. National Health Service. Available at: http://www.nhs.uk/conditions/vaccinations/pages/mmr-vaccine.aspx [Accessed 20 July 2016].

Neale, D. (ed.) / NAWE (2018) *Creative Writing: Research Benchmark Statement*. York, UK: The NAWE Higher Education Committee. Available at: https://www.nawe.co.uk/writing-in-education/writing-at-university/research.html [Accessed 25 June 2018].

Nelson, R. and Andrews, S. (2003) 'The regulations and protocols governing 'Practice as Research' (PaR) in the performing arts in the UK leading to the award of PhD'. *PARIP:*

University of Bristol [online]. Available at: http://www.bris.ac.uk/parip/par_phd.htm [Accessed 30 October 2014].

Nelson, R. (2006) 'Practice-as-research and the Problem of Knowledge'. *Performance Research* [online]. **11** (4), pp.105–116. Available at: http://dx.doi.org/10.1080/13528160701363556 [Accessed 30 October 2014].

Nelson, R. (2010) 'Practice-as-research and the Problem of Knowledge'. *Performance Research* [online]. **11** (4), pp.105–116. *Revised 'Dynamic Model' diagram on p.114, noted as 'Revised 15 February 2010'.*

Nelson, R. (ed.) (2013) *Practice as Research in the Arts: Principles, Protocols, Pedagogies, Resistances*. London: Palgrave Macmillan.

New Scientist Editorial (2007) 'Discovering the tomb of Jesus, wife and son'. *New Scientist* [online]. No. 2593, p.7. Available at: http://www.newscientist.com/article/mg19325934.200-discovering-the-tomb-of-jesus-wife-and-son.html [Accessed 19 January 2009].

Oxford English Dictionary (OED) Online (June 2017). Oxford: Oxford University Press. Available at: http://www.oed.com/view/Entry/172674?redirectedFrom=science+fiction [Accessed 6 September 2017].

Page, R. (ed.) (2011) *Litmus: Short Stories from Modern Science*. Great Britain: Comma Press.

Page, R. (ed.) (2012) *Bio-Punk: Stories from the Far Side of Research*. Great Britain: Comma Press.

Papageorgiou, N. (2011) 'Reverse Transcription'. *Lablit.com: Fiction Archive* [online]. Available at: http://www.lablit.com/article/671 [Accessed 6 March 2015].

Powers, R. (2011) *Generosity: An enhancement*. London: Atlantic Books.

Ramalho-Santos, J. (2010) 'Trash'. *Lablit.com: Fiction Archive* [online]. Available at: http://www.lablit.com/article/617 [Accessed 6 March 2015].

Rayment, T. (2011) 'Do keep up, doctor, this is changing medicine for ever'. *The Sunday Times* [online]. 7 August 2011. Available at: http://www.thesundaytimes.co.uk/sto/newsreview/features/article695135.ece [Accessed 14 August 2011].

Reich, J.E. (2015) *Fanspeak: The Brief Origins of Fanfiction* [online]. Tech Times. Available at: http://www.techtimes.com/articles/70108/20150723/fan-fiction-star-trek-harry-potter-history-of-fan-fiction-shakespeare-roman-mythology-greek-mythology-sherlock-holmes.htm [Accessed 20 July 2016].

Reichs, K. (2002) *Grave Secrets*. London: Heinemann.

Roberts, A. (2000) *Science Fiction*. London: Routledge.

Rohn, J. (2005) *Lablit.com: the culture of science in fiction and fact* [online]. Available at: http://www.lablit.com [First Accessed 7 September 2009].

Rohn, J. (2005b) *Welcome to LabLit.com* [online]. Editorial. Available at: http://lablit.com/article1 [First Accessed 7 September 2009].

Rohn, J. (2005c) *What is LabLit (the genre)?* [online]. Essay. Available at: http://www.lablit.com/article3 [First Accessed 7 September 2009].

Rohn, J. (2006) 'Experimental Fiction'. *Nature*. **439** (7074), p.269.

Rohn, J. (2010) *The Honest Look*. New York: Cold Spring Harbor Laboratory Press.

Rohn, J. (2010b) 'More lab in the Library'. *Nature*. **465** (7298), p.552.

Rohn, J. (2016) *The Lab Lit List: Novels, films, plays and TV programs in the Lab Lit fiction genre* [online]. Available at: http://www.lablit.com/the_list [Accessed 22 July 2016].

Roth, V. (2011) *Divergent*. New York: Harper Collins.

Russell, N. (2009) 'The New Men: scientists at work in popular British fiction between the early 1930s and the late 1960s'. *Science Communication*. **31** (1), pp.29-56.

Russell, N. (2010) *Communicating Science:* Prof*essional, Popular, Literary*. Cambridge: Cambridge University Press.

Russell, N. (2011) Conversation with Sean Fitzgerald at Imperial College, 10 June.

Russell, N. (2014) 'What Did Scientists Do All Day? Scientists at Work in British Fiction from the 17th to the Mid-20th Century'. In: *Fiction Meets Science Working Paper 1* [online]. Bremen: University of Bremen, June 2014. Available at: http://www.fictionmeetsscience.org/ccm/cms-service/stream/asset/Working%20Paper%201%20Russell.pdf?asset_id=1142002 [Accessed 30 October 2014].

Russell, N. (2017) [est] *The history of science in fiction* [wt]. London: [n.k.]

Rust, C., Mottram, J. and Till, J. (2007) *Practice-Led Research in Art, Design and Architecture*. AHRC Research Review Report. UK: AHRC. Available at: http://shura.shu.ac.uk/7596/ [Accessed 7 August 2015].

Ryman, G. (ed.) (2009) *When It Changed. Science into Fiction: An Anthology* [fiction-factual mix]. Great Britain: Comma Press.

Saris, F. (2006) *Science through the looking glass of literature* [essay]. LabLit.com (online). Available at: http://www.lablit.com/article/90 [Accessed 25 October 2009].

Schmidt, M., Meyer, A. and Cserer, A. (2013) 'The Bio:Fiction film festival: sensing how a debate about synthetic biology might evolve'. *Public Understanding of Science* [online]. Published online before print, 28 October 2013, pp.1-17. DOI: 10.1177/0963662513503772. Available at: http://pus.sagepub.com/content/early/2013/10/24/0963662513503772 [Accessed 30 October 2013].

Scrivener, S. (2000) 'Reflection in and on Action and Practice in Creative-Production Doctorial Projects in Art and Design. The Foundation of Practice-Based Research: Introduction'. In: *Working papers in Art and Design*, *Vol. 1* [online]. Hertfordshire, UK: University of Hertfordshire. Available at: http://www.herts.ac.uk/artdes1/research/papers/wpades/vol1/scrivener2.html [Accessed 7 August 2015].

Shelley, M. (1993) [1818] *Frankenstein: Or, the Modern Prometheus*. Hertfordshire, UK: Wordsworth Editions.

Silverstone, R. (1985) *Framing Science: The Making of a BBC Documentary*. London: British Film Institute.

Sky News Channel (2014) *DNA could create mugshots to snare criminals* [online]. Sky News International. 21 March 2014. Available at: http://news.sky.com/story/1229496/dna-could-create-mugshots-to-snare-criminals [Accessed 24 March 2014].

Sleigh, C. (2011) *Literature & science*. Hampshire, UK: Palgrave Macmillan.

Smith, Z. (2000) *White Teeth*. London: Penguin.

Steinbeck, J. (2000) [1945] *Cannery Row*. London: Penguin Modern Classics.

Steinbeck, J. (2000) [1954] *Sweet Thursday*. London: Penguin Modern Classics.

Stephenson, N. (1988) *Zodiac*. New York: The Atlantic Monthly Press.

Stephenson, N. (2001) [1992] *Snow Crash*. Missouri, USA: Turtleback Books.

Stephenson, N. (2011) *Reamde*. New York: William Morrow (HarperCollins).

Stodden, V. (2010) 'Open science: policy implications for the evolving phenomenon of user-led scientific innovation'. *Journal of Science Communication* [online]. **09** (1), pp.1-8. Available at: http://jcom.sissa.it/archive/09/01/Jcom0901(2010)A05 [Accessed 14 May 2010].

The Linnaeus Link Project (2017) https://www.linnean.org/research-collections/library/linnaeus-link [online]. The Linnean Society of London. Available at: https://www.linnean.org/research-collections/library/linnaeus-link [Accessed 3 August 2017].

Trump, B., Berezsky, I., Chang, S. and Phelpsky, P. (1997) 'The pathways of cell death: oncosis, apoptosis, and necrosis'. *Toxicologic Pathology* [online]. **25** (1)**,** pp.82-8. Available at: http://tpx.sagepub.com/content/25/1/82.full.pdf [Accessed 6 April 2010].

Turney, J. (1998) 'Public visions of genetics'. *Public Understanding of Science*. **7** (4), pp.343-8.

Turney, J. (2009) 'Science Communication in Fiction'. In: Holliman, R., Thomas, J., Smidt, S., Scanlon, E. and Whitelegg, E. (eds.) *Practising Science Communication in the Information Age: Theorising professional practices.* Oxford: Oxford University Press, pp.166-177.

Tuttle, L. (2005) *Writing Fantasy and Science Fiction*. 2nd ed. London: A & C Black.

University of Bath (2005) *Centre for Death and Society* [online]. University of Bath. Available at: http://www.bath.ac.uk/cdas/ [Accessed 6 April 2010].

University of Southampton (2008) *World's largest-ever study of near-death experiences* [online]. University of Southampton. Available at: http://www.soton.ac.uk/mediacentre/news/2008/sep/08_165.shtml [Accessed 6 April 2010].

VPHI (2011) *Building the Virtual Physiological Human* [online]. Virtual Physiological Human Institute for Integrative Biomedical Research. Available at: http://www.vph-institute.org/ [Accessed 7 May 2012].

VPH-Share (2014) *Virtual Physiological Human-Share portal* [online]. VPH-Share [online]. Available at: https://portal.vph-share.eu/ [Accessed 9 January 2015].

van der Laan, J.M. (2010) '*Frankenstein* as science fiction and fact'. *Bulletin of Science, Technology & Society* [online]. **30** (4), pp.298-304. Available at: http://bst.sagepub.com/content/30/4/298 [Accessed 3 September 2010].

Vision of Britain (2009) *Descriptive Gazetteer Entry for LIVERPOOL* [online]. University of Portsmouth. Available at: http://www.visionofbritain.org.uk/descriptions/2121510 [Accessed 24 July 2015].

Webb, J. (2015) *Researching Creative Writing*. Suffolk, UK: Frontinus Ltd.

Wells, H.G. (2005) [1895] *The Time Machine*. London: Penguin Classics.

Wells, H.G. (2005) [1896] *The Island of Doctor Moreau*. London: Penguin Classics.

Wells, H.G. (2006) [1905] *A Modern Utopia*. London: Penguin Classics.

Wilson, E.O. (2010) *Anthill*. New York: W.W. Norton & Company.

Wolpert, L. and Richards, A. (1989) *A Passion for Science*. Oxford: Oxford University Press.

Wolpert, L. (1997) 'In praise of science'. In: Levinson, R. and Thomas, J. (eds.) *Science Today: Problem or crisis?* London: Routledge, pp.9-21.

Wray, J. (2013) 'Ursula K. Le Guin, The Art of Fiction (No. 221)'. *The Paris Review*. Issue 206, Fall 2013. Available at: https://www.theparisreview.org/interviews/6253/ursula-k-le-guin-the-art-of-fiction-no-221-ursula-k-le-guin [Accessed 6 September 2017].

Wyndham, J. (2008) [1951] *The Day of the Triffids*. London: Penguin.

Yearly, S. (1998) 'Trust in Science'. *Science and the public*. S802: Part B. Milton Keynes, UK: The Open University, p.3. (Open University MSc Science course material.)

Young, E. (2009) 'Sleep well, stay sane'. *New Scientist*. No. 2696, pp.34-7.

APPENDICES

Appendix (i)

Nelson R. (2010): A Revision to the Original Dynamic Model for 'Practice as Research' (PaR)

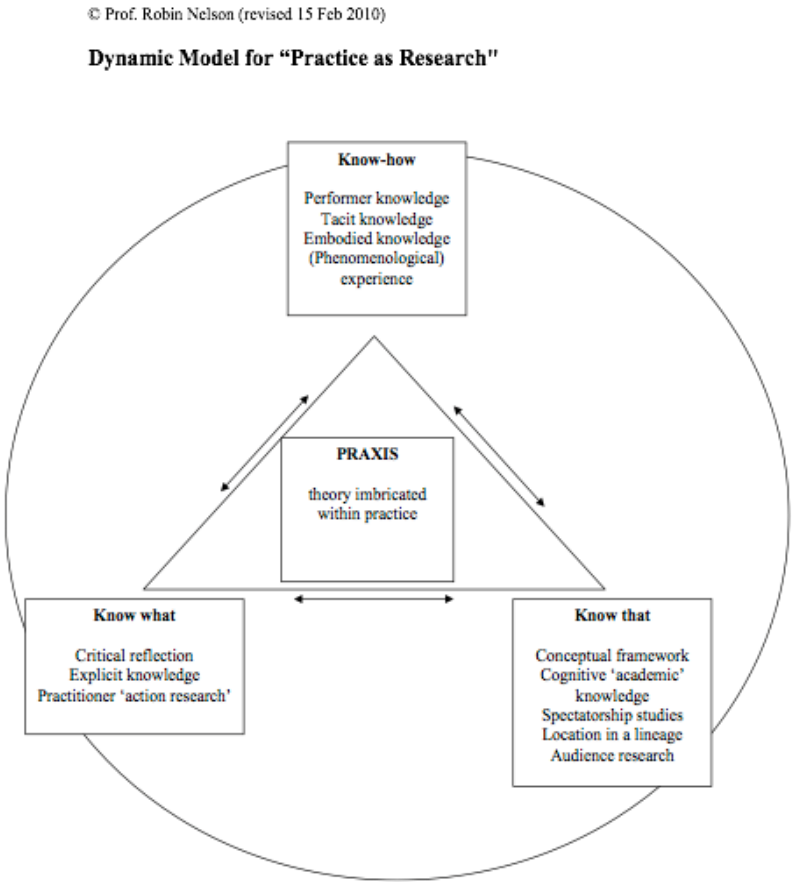

Fig. 1: Dynamic Model for PaR (Nelson, 2010).
(This is a revised diagram following the original published in: Nelson (2006) 'Practice-as-Research and the Problem of Knowledge' (p.114). As cited in a presentation by Baugh (2012) at University of Winchester.)

Appendix (ii)

Nelson R. (2013): Modes of Knowing: Multi-mode Epistemological Model for 'Practice as Research' (PaR)

Multi-mode Epistemological Model for "Practice as Research"

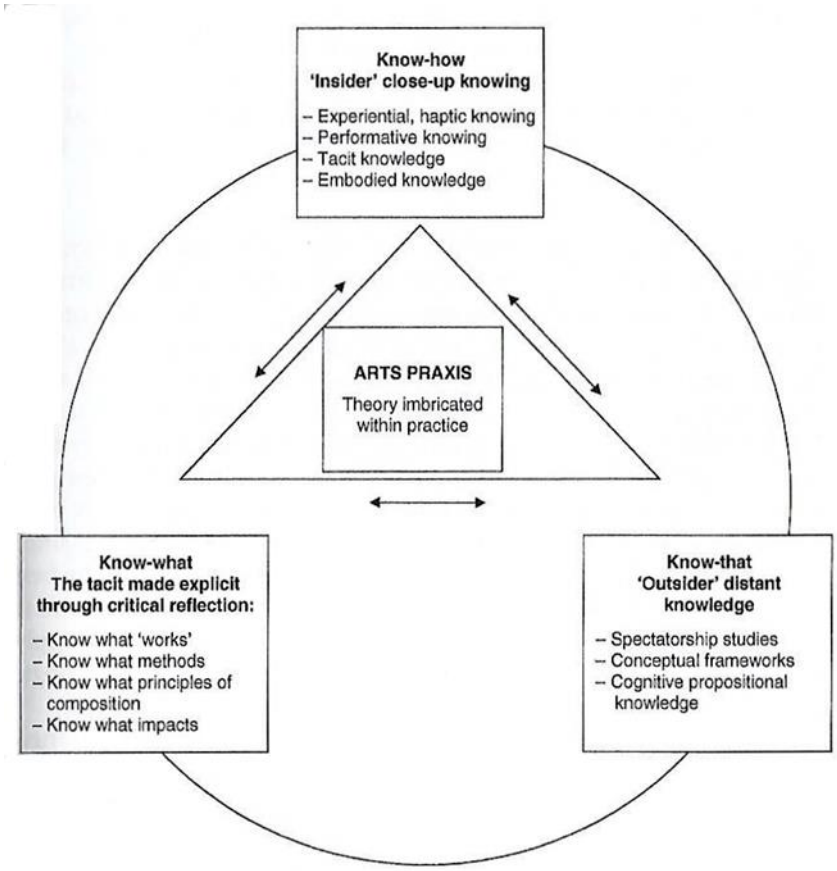

Fig. 2: Modes of Knowing: Multi-mode Epistemological Model for PaR (Nelson, 2013, p.37).

Appendix (iii)

<u>The process of selecting a corpus of work for an examination of science-as-fiction literature</u>

The corpus selection qualitative criteria were as follows:

1. Choose a manageable amount of material of up to thirty fiction books (including novels, novellas, novelettes and fiction collections) and up to five (online[99]) pieces, as representing popular fiction works written between 1988 and 2015;

2. Where possible choose character-driven narratives;

3. A cross-section of scientific topics but with a slight bias towards genetics and bio-engineering, as this is where the majority of the subject matter of my creative practice is likely to sit;

4. In story-specific terms, the scientist character should be seen frequently in their laboratory or professional place of work (e.g. in the 'field', if a geologist);

5. A significant amount of the storyline(s) content should be centred on science processes and the resulting consequences of undertaking the science;

6. The scientist should be one of the main or joint main protagonist;

7. The professional life of the scientist/s is/are explored in some detail;

8. The personal life and personality of the scientist/s is/are explored again in some detail;

9. In character-specific terms, the scientist should be professionally qualified and so viewed as a scientist by profession, although not necessarily with a doctoral-level qualification, and finally

10. A conscious effort is to be made to avoid using (depictions of) scientists from history occupying the only main protagonist role within the science-as-fiction piece.

Although there are a wider range of contemporary works of fiction which deal with science and scientific subjects e.g. Zadie Smith's *White Teeth* (2000) and Carole Cadwalladr's *The Family Tree* (2005) amongst others, I felt that novels such as these despite dealing with '"…the nature of science"' (Rosalind Driver *et al*., from Eileen Scanlon *et al.*, 1999, p.4) did so in a way which was only incidental to the plot and not integral to it. The corpus therefore consists of works which rely on the character of scientists and science (principally) to drive the plot. In these fictions both the techniques of science are illustrated through the experiences of scientists (and science professionals/personnel) and an insight offered into how the processes of science work (in a contemporary society/culture).

[99] Online pieces chosen for ease of access to readers of this research study.

Critically, within Rohn's Lablit choices and Russell's notion of looking closely at the processes of undertaking science there is no place for unnecessary didacticism, new wave science fiction or fantasy as typified by such authors (respectively) as Djerassi, William Gibson and William S. Burroughs, as indicated by Robert Lambourne's essay 'Science fiction and the communication of science' (1999, p.152). The latter two categories of fiction (new wave science fiction and fantasy) do not often exhibit tangible evidence of scientists (professionals) being engaged in the technical process of undertaking science and even less, in recognised laboratory or field work. However, although this research study aims to steer clear of science fiction as a genre, there are certainly aspects of the mechanics of writing both science fiction and science-as-fiction that share some common ground when their aim is one of communicating science-in-fiction, especially when the main focus of the writing concerns a fictional scientist and the portrayal of why they do what they do, through the process of doing science. Lambourne views these subtleties of communicating science in science fiction as encompassing areas such as the '...nature and purpose of science, the process of science, the character and experience of scientists, or the historical, political and sociological aspects of science, including its impact on society' (1999, pp.146-7). Most of these categories would find resonance within science-as-fiction works and may even find common ground with those from both historical writers of science romance (notably Wells and Arthur Conan Doyle) and modern writers of so-called 'hard' science fiction (such as Isaac Asimov and Robert A. Heinlein). But on a cautionary note, Lambourne considers that science fiction is not necessarily the best (fictional) space for discussing and engaging with science: 'Communicating science is rarely a primary goal of a science fiction [or fantasy] author and is often not a concern at all' (1999, p.156). In the following two chapters I will address concerns raised by Lambourne and others as I explore the approach taken in designing science-as-fiction pieces in a style that integrates factual science and fiction and sets out to examine this (research practice) within a critical-creative framework.

Corpus Selection

Traditionally published books

Barrett, A. *Ship Fever* (mixed-length fiction collection, 1996).

Barrett, A. *Archangel* (2013).

Boyd, W. *Brazzaville Beach* (1990).

Boyd, W. *Ordinary Thunderstorms* (2009).

Byers, M. *Long for This World* (2004).

Byers, M. *Percival's Planet* (2010).

Chevalier, T. *Remarkable Creatures* (2009).

Crichton, M. *Jurassic Park* (1991).

Crichton, M. *Prey* (2002).

Djerassi, C. *Cantor's Dilemma* (1989).

Docx, E. *The Devil's Garden* (2011).

Gaines, S.M. *Carbon Dreams* (2000).

Goodman, A. *Intuition* (2009).

Lethem, J. *As She Climbed Across the Table* (1998).

McCabe, J. *Paper* (1999).

McCabe, J. *Snakeskin* (2001).

McEwan, I. *Enduring Love* (1997).

McEwan, I. *Atonement* (2001).

McEwan, I. *Saturday* (2005).

McEwan, I. *Solar* (2010).

Mawer, S. *Mendel's Dwarf* (1997).

Mawer, S. *Tightrope* (2015).

Powers, R. *Generosity: An enhancement* (2011).

Reichs, K. *Grave Secrets* (2002).

Rohn, J. *The Honest Look* (2010).

Stephenson, N. *Zodiac* (1988).

Stephenson, N. *Reamde* (2011).

Wilson, E.O. *Anthill* (2010).

Published online / *www.lablit.com* fiction[100]

Brennicke, A. 'Seedy Dealings' (short, 2009).

Ghosh, J. 'A Quick Spin' (short, 2008).

Goldschmidt, P. 'An investigation into love by Babcock and Wainwright' (short, 2015).

Papageorgiou, N. 'Reverse Transcription' (short, 2011).

Ramalho-Santos, J. 'Trash' (short, 2010).

[100] These individual pieces can be accessed online from within the fiction archive section on the *Lablit.com* website: http://www.lablit.com/archive/18, and are listed in the Bibliography.

Appendix (iv)

<u>Continuation of Full Comparative Analysis Findings for Categories iii – vi (inclusive) presented from Comparative Analysis Research (B.) undertaken between 'Birds With No Feet' and 'The Patient Experiment' (from Thesis Chapter 5)</u>

iii. By what method is science and scientific culture disseminated in the story: as metaphor, as a sociological factor or as a philosophical factor?

AB: 'Birds With No Feet' ('BWNF')

I put forward that all three methods are used to a lesser or greater extent, in presenting the relevance of the science—and that of the scientific culture—to the reader.

Metaphors abound in this piece but not so much as to render their use ineffective. In a story which deals with Natural Selection one of the most obvious metaphors from the main story is that the central protagonist (Alec) falls foul of a simple 'survival of the fittest' rule, as he tries to compete with, and fails, against Alfred Russell Wallace.

From a sociological perspective, science and scientific culture is drawn out in comparisons between the 'western' and 'non-westernised' cultures. How the 'scientists' view the world of the 'natives' and in turn, how the indigenous peoples view and welcome the scientist explorers—or plunderers—without fully understanding what their actions will bring in the future, is developed as an integral part of the story. As in many systems of inequality, the economies of supply and demand drive the relationships between the two groups.

Philosophically, the story seeks to re-affirm the notion of the scientist as both an outsider but also part of the western establishment. Furthermore, the author makes some keenly observed points on the (future/contemporary) exploitation and destruction of the rain forests and with a certain irony, the future potential of science to repopulate denuded rain forests with lost species, through genetic engineering.

SF: 'The Patient Experiment' ('TPE')

Philosophically, there are several subjects touched upon in this fiction. The main issue for concern is the ethical consideration of animal experimentation, brought shockingly to the fore as the 'animal' being experimented on is a human being. Leaving aside obvious emotional responses, notions of when—and if—it is ever right to 'experiment' (in the loosest terms) on fellow humans, as well as reflecting on theoretical legal issues of 'living wills', the right to die a dignified death at the time of one's own choosing and whether there should be end-of-life medical intervention to limit a person's suffering, are all questions that the story could look to ask. One of the key philosophical points that this piece raises is the scientific

research into 'near-death' studies and whether this scientific study can prove to be anything other than a sideshow of misdirection.

From a sociological viewpoint, the story examines how the study of 'near-death' experiences is exploited for commercial and profitable gain by the Centre for Life Experiences scientists, at the sister facility of The Harvey Centre. The CLE itself runs as a well-oiled but medically sterile machine and the people who seem to be at odds with 'its' world view—Nurse Arthurs, TP and eventually, Jake—only have one avenue of action open to them, to 'escape' (in a variety of ways) as best they can. The world of the CLE is all-controlling: with the pursuit of lucrative scientific research the only endgame.

The use of metaphor is deliberately sparse in 'TPE', but loose instances can still be found within the piece. These are illustrated as such: TP is seen as being more of an 'expert' on his condition than any of the researchers/doctors at the CLE (and so is the only one in position to decide on his future); TP is considered no more than an 'experimental animal [who] speaks'[101] and is therefore the person who needs to be silenced the most, and Jake—as the pawn—is slowly uncovered as much as the subject of an exploitative experiment as that designed for TP.

Comparative conclusions

Science and scientific culture are evident in both fictions, as straight-forward narrative elements: for example, AAS in 'BWNF' and the pursuit of Alec (partly) in his desire to be accepted as an equal by the scientists of the Academy, and in 'TPE', the post of Psychological Researcher, which offers Jake the promise of a new direction in his career, to work with sick minds and not sick bodies.

Whilst the narratives need to work on the level of cause-effect-conflict-resolution, there is also the need for each narrative to be able to work beneath this level, to be able to put across ideas and develop other narrative (sub) strands, which are not always immediately obvious, hence the consideration of how metaphors and other factors (sociological and philosophical) are used, to provide a subtext to the main storyline. This is a key element within science-as-fiction literature and its use varies; it could be simply to provide another level of storytelling which complements the science-fact or factual scientific-culture designed to engage those readers who would not be that interested in the 'science', but are interested in what the story is about and what it can say. Or it could be used to hypothesise on and to further develop the scientific ideas that the main narrative revolves around but is not

[101] Conversational quote from a meeting with Dr. Russell, Imperial College, 10 June 2011.

allowed to delve too deeply into, in danger of weakening that main narrative thread by leading it off on a tangent. (An example of this type of 'hyper-scientific narrative thread' would be found in any number of Crichton's science-thriller novels, ranging from *The Andromeda Strain* up to *State of Fear*.)

The use of metaphor to add a richness to a science-as-fiction story is one way to be able to discuss with the reader areas of science and scientific culture, that whilst not directly part of the main narrative thread, could be relevant to the 'world' of the story and would help make sense of that story in a wider—historical or contemporary or near-future—context. In Barrett's 'BWNF' (set in the mid-19th century), metaphors are used to help contextualise the narrative struggle undertaken by Alec and ultimately, show how inconsequential his work will be in the development of (evolutionary) science and the field of Natural History, with his only (fictional) claim to fame being the first introduction of a live Bird of Paradise to the North American peoples. In 'TPE', metaphors are employed somewhat differently due to its contemporary setting. They are made use of as an illustrative tool to help comment both on the state of the commercialisation of medical science and the predicaments that the main protagonist Jake, and the other (sympathetic) characters, find themselves in.

How the fictions utilise sociological factors to portray science and scientific culture is interesting and remarkably similar in both instances. When considering the sociology of these two science-as-fiction pieces, what needs to be considered is the 'world system' in which the narrative operates and how science and the scientific culture interacts within that world. In 'BWNF', a (historically based) world is created where the culture of science is the culture of the 'civilised' (western) world and through exploiting the riches of the 'uncivilised' world, the benefits can be harvested in the pursuit of a greater scientific understanding. In addition, there are factors that also address a unique microcosm: that of Alec and his place—at the bottom—in this 'world system'. In 'TPE', the 'world system' is a much more recognisable and contemporary one but similar sociological factors are at work, as in 'BWNF'. The controlling scientific culture—in which the story itself operates—is an all-powerful one of medical research and the benefits it can offer, at the extortionate expense of those caught up on the wrong end of the whole process. As the narrative unfolds, the only realistic option for the future comes at a high price for Jake and for TP, as much the same as is expected for Alec, in 'BWNF'.

The philosophical factor is a feature that both fictions make use of in delivering thoughts and concepts related to science and scientific culture, within their narratives. In 'BWNF', the subtext is able to raise core ideas of scientists and scientific culture as at once operating outside of society and at the same time, being at the heart of it, driving and shaping its

progress. These same concepts are raised in 'TPE', albeit with slightly less weight behind them but with added emphasis focussing on experimentation in the name of scientific research that floats a speculative question: 'How far is science (and scientific culture) willing to go, in the pursuit of progress?'.

Inevitably intertwined with philosophical factors are ethical questions. Here, both pieces seem able to raise a question of ethics—both directly and indirectly—within their respective narrative structures. As a direct comparison, both raise the ethical question (as a continuation of the philosophical factor above): 'Is any price worth paying for the advancement of science?'. In 'BWNF', this is raised by the central character Alec, as a direct questioning of what his life has been about and his (lack of) achievements; with 'TPE', the point is a more indirect one, as the reader considers the justifications of keeping TP alive and is confronted by the question, 'Is the pursuit of a non-essential treatment/cure more important than a person's right to be able to die?'.

iv. Is the science and scientific culture a component of the narrative or does the narrative rely on the science and scientific culture for the narrative to work?

AB: 'Birds With No Feet' ('BWNF')

This particular narrative would not operate by itself in absence of the science and scientific culture within the story. Science is central to the theme of the story but also forms the framework which the piece relies heavily upon in terms of key historical facts and events. A fiction could be written about this collection of characters in the same temporal and geographical location without much or any science being alluded to at all but the piece, as it stands, is a richer experience for the inclusion of the science content.

SF: 'The Patient Experiment' ('TPE')

This narrative relies heavily upon science and scientific culture, albeit in the guise of medicine and cutting-edge scientific research. It is this culture that is integral to the nature of the story, and although the form does loosely make use of a light thriller/conspiracy structure, it is the science and scientific culture that lies at its heart. The drive of the piece comes both from the discovery of the components within the narrative (through plot revelations) and of the science and scientific culture that is 'uncovered' by Jake, which helps him patch together what is happening (to TP) at the Centre. Without the specifics of the science and the culture in which it operates, the story would not be able work as a narrative, as the scientific fact (and plausible speculation) gives both a meaning and an empirical science experiment-led structure to the story.

Comparative conclusions

With both of the fictions under consideration, the narrative does rely on the science and scientific culture of the individual story-world to be able to deliver the meaning and the respective point of the pieces.

In comparison, 'BWNF' operates within as much a scientific 'establishment' and scientific culture as 'TPE' does, despite the geographical, spatial and temporal gap between the settings of the two tales.

Each of these fictions share the value of a distinct, central scientific theme at its heart and it is this theme that drives the narrative and the characters forward.

Despite the differing narrative styles in evidence—with 'BWNF' using a more literature-based (journal/letter) structure, whilst 'TPE' with its literature pretensions including a light 'thriller' style—the different frameworks are both that of a journey of scientific discovery, undertaken in the culture of a scientific world, with obvious boundaries to that world.

The plausibility of these two (scientific) worlds, in which the respective narratives are constructed, is crucial for their understanding and acceptance. The narrative components need to rely on the scientific culture of an historically accurate environment in which 'BWNF' exists, and with 'TPE', the reliance is on a contemporary, medical-research facility recognisable at least in spatial, physical and shared-experience terms.

v. Is the science and scientific culture an accurate, or at least plausible, representation of a 'real-life' scientific experience?

AB: 'Birds With No Feet' ('BWNF')

At face value, the scientific content does seem to offer a realistic experience of an historical period during the development of the Natural Sciences in the nineteenth century. So, it would be plausible. If the time is taken to investigate beyond the surface, then a whole host of factual characters, reference books and societies reveal themselves amongst the plausible fiction: Titian Peale at the (American) Academy of Natural Sciences; William Edwards' book, *A Voyage up the River Amazon*; Wallace's 1855 paper on the possible origin of species, etc. All of these factual elements add to the scientific experience even if the actual experience is that still of a work of (mainly) fiction.

SF: 'The Patient Experiment' ('TPE')

The Oxfordshire setting is a fictional one of a contemporary research institute, investigating areas surrounding 'near-death' studies, along the lines of similar factual centres such as the Horizon Research Foundation (UK and USA) and The Centre for Near-Death Studies (UK).

In respect of the medical elements in the story—the use of the research into 'oxygen free radicals' and associated toxins, the recognition and treatment of 'Reperfusion Injury' in the brain cortex, 'Ischemia' and its relation to 'cardiac arrest', the pioneering treatment of the cooling of the brain cortex/core body areas to arrest cell damage caused after trauma—all of these are accurate in a contemporary medical scientific culture[102]. There are elements of plausible medical science, which again have some basis in contemporary research (for example, the potential treatment of depression by stimulating the parts of the brain cortex which react to situations of 'near-death' or actual death). There have also been minor links between areas of current research which could be made but may not be (currently) factual but are plausible and do represent a 'real-life' medical scientific experience, nonetheless. These latter connections are used to enable the fiction to work as required.

In general terms, the novelette is a work of fiction but with 'real-life' or plausible medical and scientific elements central to its core.

Comparative conclusions

Considering both fictions and how representative they are of a 'real' experience of science and scientific culture, the main consideration in any analysis should be: 'Does the story seem plausible enough to either have happened in the past or happen now, in a scientific culture of what could reasonably represent a 'real-'life' scientific experience (as opposed to futuristic and/or fantasy-based scientific cultures)?'. Without too much doubt, I would say that both pieces fulfil this criterion.

Barrett's historical piece, 'BWNF', is steeped in aspects of a scientific culture that existed and is much researched in its own right. By using recognisable places, people, factual texts, research methods and locations as an interactive background for the author to place the main protagonist—Alec Carrière—into, helps the reader experience what it was possibly like to be at the forefront of evolutionary biological research in the mid-19th century. This works remarkably well, at least for the purposes of telling a narrative story. Perhaps in a more rigorous investigation by an expert in that particular field of historical scientific research,

[102] These elements were recently discussed in an episode of BBC Radio 4's *In Our Time* on the subject of 'Free Radicals', first broadcast on 1st Nov 2018. The novelette, 'The Patient Experiment', was conceived of and first written in its current form in 2013. Five years on, aspects of the speculation in the fiction have now become reality.

gaps would be opened up. However, this is not the point, the point is the creation of a plausible, scientific culture in which a (fictional) tale of science and scientists can be explored.

Although, in some ways it is easier to build and elaborate upon an 'historical world', some of the same techniques which have been used in 'BWNF' to create a believable and plausible, scientific world, have been employed in 'TPE', for similar effect. With the use of a (plausibly) recognisable medical-research facility, the language of medical and scientific research, relevant medical terms and scientific treatments, along with supportive texts and factual research, a story-world is created that could be recognisable as one which would support the type of medical-research culture of the 'TPE' narrative. This forms—as in 'BWNF'—an interactive backdrop in which the narrative of Jake Balfe and TP can plausibly unfold and be understood as a story set within, and about, a defined scientific culture.

Undoubtedly, there will be areas in both fictions that stretch the limits of what a scientist—or a member of a relevant scientific culture—would recognise in their professional lives as 'real-life'. However, it is hoped that with any piece purporting to be science-as-fiction (literature), these would be minor concerns and be outweighed by the majority of the created, fictional world which would be accepted as plausible, in the realm of (a) distinct science and scientific culture.

vi. How is the science and scientific culture revealed in the storytelling: first person; letter; journal; third person; omnipotent narrator or a combination of all these mixed approaches? And by whom (their role) as: direct experience; past experience (memory); indirectly (second-hand) or just through pedagogic dialogue, in a more didactic manner? What effect does this have on the style of storytelling?

AB: 'Birds With No Feet' ('BWNF')

The main narrative formal device is third person as it reveals what Alec does and how others react to what he does. There is also an omnipotent presence and some direct experience related in correspondence between Alec and Wallace. Most of this communication is matter-of-fact but the final correspondence to Wallace—perhaps of Alec's life—reveals a self-awareness of his own failure to make an impression in his chosen scientific field or even enough money to live on, let alone keep up his research at a recognised institution.

Alec views science and scientific culture to be something that other people like Wallace practice and which he can only fleetingly touch upon. Through Alec's experience and his meetings and correspondences with Wallace, the scientific culture of the Victorian age—specifically of the pre-Civil War in America—and the dawn of the joint 'Theory of Evolution by Natural Selection' and of *On the Origin of the Species* (1859), is succinctly framed. Although the thoughts of the main character are relayed to the reader throughout the story, it is only

over the last two pages that Alec is given his voice. As he is about to face the horrors of battle and a fair chance that he will be killed or severely injured, Alec reveals his feelings about the new life that pursuing science had offered him but was simply taken away due his apparent failure to engage with the academic nature of that culture. He reveals that without really knowing it, he had become an accomplished naturalist in the forests of the Pacific Rim and with some irony, makes an academic observation that he suspects could rival that of Wallace and Darwin: possible evolution through intervention pushing Nature to clone those species that are on the edge of extinction. A spurious theory but at least Alec is now finally thinking like a scientist. With these last thoughts, his character meditates on the wilful destruction of whole species in the name of science and the realisation that these precious resources are finite, and how he too had destroyed them in his pursuit of wanting a better life.

The style in which the story is told is very much in the mould of personal reminisces or fragments of a life, as it allows the reader to move back and forward through time and space, to follow the journey of Alec. There is a certain pre-destination or natural selection in what happens to Alec in the story and this mirrors some of the (scientific) context contained within that piece. The tale catches his most triumphant moments but also experiences the depths of his melancholia, sickness and despair. All of which are directly or indirectly caused by his pursuit of science and the money that it could bring. In trying to secure a sound financial position—he lacks the patronage and privilege of Wallace—Alec is the originator of his own downfall as he does not have the time consider the academic nature of what he is doing and often forgoes the pursuit of a 'scientific method' or 'mechanism' as Wallace puts it, that would elevate him above the status of an adventurer-collector. Ultimately for Alec, there is always the distant hope that he will be accepted into the scientific fold, to be recognised by his peers. Although in his final (direct) thoughts Alec comes to realise that he has no peers and he has been serving a scientific community he now feels ultimately excluded from and in the end, regrets his actions in the pursuit of scientific endeavour.

SF: 'The Patient Experiment' ('TPE')

The science and scientific culture is very much revealed by experiencing it with Jake directly, as he starts at the CLE, discovers TP, then TP's predicament, through undertaking his own research into what has been happening to TP, and ultimately, how he finds a way to release TP from his contractual obligations (to medical science).

Although a first person narrative style is not used and there is no direct communication between Jake and the reader, it is still possible to get a look into Jake's mind through his thought processes—albeit as third person and so a second-hand device—to develop an

insight into how and what he is thinking, especially as he tries to makes sense of both the science and the scientific culture which confront him.

Indirect methods are also used to provide Jake with scientific information, journals, on-line sources, medical reports and medical case notes – in this way, the reader experiences directly what Jake discovers, first-hand.

There are some past-experiences or revelations which are remembered by Jake, as this new challenge brings them back to his consciousness. This helps to give both a depth to his character and allows the reader possible insights into the reasons as to why he acts—and will act—the way he does. These have the narrative function of generating an empathetic relationship between the character and the reader.

There are elements of the science (and the scientific culture at the CLE) that are revealed to Jake through his conversations with other characters (notably Nurse Arthurs, Sister O'Rourke and TP himself). These threads—which could fall into a more pedagogic category—often send Jake on specific journeys of discovery, to find out further key information or to help piece all the disparate elements together, in order to arrive at a decision that he is ultimately able to act upon, after a reasoned deduction.

On the whole, the revelatory conversations that Jake has with the characters at the CLE do push him to act and think in a certain way. So, this drip-feed of (scientific and personal) information does lend the storytelling a certain 'conspiracy thriller' edge to it but not to its detriment, as it still manages to ask some questions about ethics and contemporary medical research.

Due to the close alignment of the story to a distinct and intense period of Jake's life, and his presence in almost every scene, it very much feels like the reader is taken on a voyage of discovery—alongside Jake—and what is experienced, is a shared experience.

Comparative conclusions

'BWNF' and 'TPE' both, in the main make use of a third person narrative device. In each piece, this mechanism closely follows the main protagonist's experiences and their narrative actions. Overall, this has the effect of the science and scientific culture being mainly encountered by the lead characters—Alec and Jake respectively—and often is only observed by the reader. Although in 'BWNF', there is some attempt to make a direct connection between the main character of Alec and the reader, through the use of Alec's correspondence with Alfred Wallace. This has a particular impact that is lacking in 'TPE' as it creates a direct link to the protagonist, his thoughts, aspirations and later, his realisations of his relative failure and impending doom, without the mediated intervention of an

omnipotent narrator. This is particularly poignant and extremely effective, as the reader experiences directly Alec's final 'scientific' thoughts, in his letter to Wallace. Alec starts to piece together what his life's work has been about and his recognition that he had become (in another life now) what he set out to be—a naturalist—but also becomes aware of the stark reality that without the financial security he looked to attain, he can never be an academic or a scientist.

In 'TPE', there is no similar level of direct experience of the science and scientific culture for the reader to encounter through the character of Jake. The style of the narrative (light thriller/conspiracy) invites a reader to experience what happens to Jake - as an observer with him but not through him. This could easily place a barrier between the reader and main character—and effectively the story—if the mediation was manipulative and restrictive. In fact, although the reader does not directly experience what the character Jake feels, the use of a revelatory style of narrative, where the reader and the main protagonist discover the information (both story and scientific) at the same time, does in some way provide a bond between the character of Jake and the reader. This would not be as strong as the direct approach found at the end of 'BWNF', but it does provide a solid narrative platform for the science and scientific culture to be introduced and explored within the story and experienced by the reader. There are, however, some minor attempts at providing a more direct link between Jake and the reader, in respect of when scientific information is being considered. This is through Jake's thoughts, as he considers firstly what TP's medical condition is, and then what the Centre's treatment of TP has been.

The style of storytelling in 'BWNF'—including the commentary on science and scientific culture—is very different than that of 'TPE'. With the former, the narrative relies on providing an omnipotent, episodic treatment of the main protagonist's 'scientific' life and is able to pick out salient (historic) episodes which are drawn together in the final scene/pages that act as the present tense of the story. With the latter, the story follows a more linear and contemporary single episode in the main protagonist's life. It considers the scientific culture of a private establishment, and how the central character becomes involved in a medical conspiracy that rapidly entangles him.

With both these fictions, there are certain levels of science-based exposition or of 'telling science' to the readers. This happens in 'BWNF' through conversations and letters mainly between Alec and Wallace, and to some extent through the scientific and anthropological texts through which Alec learns his trade and calling from. In 'TPE', scientific information is imparted through conversations both between Jake and the medical staff and his patient (TP), and through the research material both Jake and TP have access to and read. To a

certain degree, there is always a need for a level of pedagogic dialogue as delivered through characters and text material. Even if the style of this story was an almost complete direct experience of a first-person narrative, sooner or later there would probably be a need to explain, or have explained, a particular scientific notion or aspect of scientific culture to the main narrator. The key concern with the nature of a narrative pedagogical element is threefold: how is it delivered; does it make sense that these particular characters are discussing this and is it at an appropriate level for the characters having the conversation?

One common stylistic element these two pieces share is that the main protagonist is almost ever-present in the story frame. There is a close alignment with the character's experiences and how the reader both perceives and encounters the story. This helps to cement the relationship between them.

In structural terms, with one of the fictions having an historical setting but written in modern times ('BWNF'), and one written and set in a contemporary timeframe ('TPE'), there will always be discrepancies when undertaking a comparison. For instance, Barrett's 'BWNF' can enrich its scientific cultural narrative with the benefit of historical figures, backgrounds and hindsight, and is able to bring a richness by drawing in philosophical and metaphorical elements from a wide base. Compare that with the contemporary piece, 'TPE', which relies on less well-known scientific cultural elements but has the attraction of delivering something that whilst not new and original, offers a different approach in its setting, characterisations and storyline.

On a final technical point neither protagonist (Alec nor Jake), is offered a complete overall resolution and in some ways, both narratives are left open-ended. However, in terms of science and the culture of science, both narratives are fully resolved, with a satisfactory (or otherwise) resolution of these issues: for Jake, he has expunged his guilt by using the scientific culture which created it in the first place, and for Alec, he has tried to become a scientist which he belatedly realises he has achieved but now has to forsake that life for another one, leaving that scientific culture behind.

Appendix (v)

<u>An applied consideration of the practical challenges in using dialogue to convey scientific information</u>

In reflecting on the challenges of using dialogue to convey scientific information, I will consider aspects of this specific challenge and offer illustrations on how I approached them, from across my research collection. (This reflection should be considered alongside relevant material in Chapters One, Four and Five.)

'The Commuter Lab' – The main protagonist character of Peter McAvoy, is purposely positioned as an 'outsider' in the field of cutting-edge biotechnology and genetic manipulation. His background does allow him to start from an advantaged position, but he is not a scientist or science professional, unlike the characters of Professor Randall, Amy Avelyne and Dr. Hawkes. Peter's friend, TT, is knowledgeable about bio-science and the processes in undertaking genetic research although (in this fiction) he is seen too as an 'outsider' and has the status of a guerrilla/amateur scientist. Peter's undergraduate degree in Biology and his Masters in Bio-engineering equips him with both an understanding of, and capability to get to grips instantly with what TT conveys to him about what he suspects Peter has come into possession of. This ability to hold conversations at a more advanced level cuts down on the amount and level of exposition needed in explaining the basics of genetics and bio-science and means also that the narrative pace does not temporarily reduce to a crawl during overly long and complex discourse. This does not mean that a reader would need a degree in bio-science to be able to follow the conversation detail in the dialogue: it has been designed to operate at an accurate but uncomplicated level that conveys the essence of the scientific detail required for the narrative to function in the way it was intended to.

As an illustration of using dialogue to convey scientific information in my research practice, the following two short extracts from 'The Commuter Lab', considers a discourse between TT and Peter that takes place during their initial scientific analysis into what the material contained in the vacuum flask might be:

> "'Here we are,' TT said. 'This profile is a bit more interesting. Survival across an extremely wide temperature range. Unusual for a fungus. Genome made up of eight chromosomes and over ten thousand genes. Fairly complex for such a small critter aren't you. Quite similar in make-up to an *Aspergillus*-type fungal spore. I wonder what your party trick is?' TT looked up. He turned to Peter. 'Any ideas on this?'"

And following with TT…

"'That's highly unusual. The Network has sent an immediate reply.'

'That's good isn't it?'

'It's unnervingly quick. I've known it take weeks to get a reply from them before.' TT sounded concerned.

'Open it and let's find out what we've got. If it's a new species we can name it. How about *Aspergillus Peterus*?'

'Somehow I don't think you'd want this type of fungal mould named after you. It could well turn out to be the cause of the next major bronchial epidemic.'"

(Fitzgerald, 2018, pp.37-8)

As it is my intention to keep the scientific detail in the discourse as accessible as possible, where appropriate, I have designed the dialogue to be natural in style and use as much everyday language as is reasonable, when dealing with complex scientific information. In the sample above, I have used the terms: 'fungus', 'genome', chromosomes', 'genes', '*Aspergillus*', 'fungal', 'spore', 'species', '*Aspergillus Peterus*', 'mould', 'bronchial' and 'epidemic'. The majority of these scientific terms are also ones of general use and whilst they are very specific in what they mean—in scientific usage—these would not deter a reader in following a passage such as this. While there is more complex scientific language used across the novelette—and generally, in my collection—where possible I try to mix the complex and the everyday, to achieve a reasonable balance without losing the scientific credibility that I bring to my speculative fiction.

As further illustration, I will consider a sample from each of the two remaining fictions, in a similar style.

From 'The Patient Experiment', I have chosen a passage of conversation between Jake and TP that offers a 'light touch' approach to a discourse concerning euthanasia, the ethics of 'living wills', the science of near-death studies and the process of 'death' from a medical perspective. As in my proposal above, this approach is designed to appeal to a general reader and make science-as-fiction as accessible as possible.

Starts with Jake:

"'Which is why I'm here today. Your choice about your own life and death.'

TP nodded. ‘Go on.’

‘I’ve completed a thorough reading of your extensive folders and case notes. The most disturbing item has to be the disclaimer you signed in your “Living Will”. I’ve no doubt of the validity of it and that you were of sound mind but medical ethics have moved on in the last seven years…’”

And following with TP…

“‘And your point being?’

Careful, Jake thought. ‘My interim conclusion is that you are caught in a slow but noticeably downward spiral. As a result there continues to be a degradation of your mental well-being and acceptable quality of life.’

TP looked pensive at Jake’s statement. ‘The point with a spiral is that once you’re caught in it there are two things which are inescapable: there is a finite point, and the more you fall, the quicker that finite point is reached. I was in engineering. These certainties I can appreciate.’

‘I would suggest that your experience of well-being “highs” followed closely by depressive episodes then stabilisation, has been spiralling in on itself for at least eighteen months.’

TP nodded. The lines on his face appeared to deepen.

Jake wondered if he had gotten to the point a bit too bluntly.

The retired engineer took a seat in the single recliner opposite. Jake could see that TP was upset by his analysis.”

And following…

“Jake stayed silent. Notions of mercy-killings and euthanasia flashed through his mind fuelled by those of his own medical mis-judgement. He dismissed these feelings. He was still a doctor in consultation with his patient.

‘I’m not saying that I wish to die. I would just like to take my chances with mortality. Same as everyone else.’”

(Fitzgerald, 2018, pp.65-6)

This period of conversation needed to be sensitively handled, as well as convey background medical, ethical and scientific issues. It is delivered at a moderate pace with reflective pauses built in, to accommodate ‘thinking time’ for the characters. The medical detail is subtle but

the scientific and medical implications of what they are discussing are obvious but, at the same time, simple to follow and understand. These subtle conversations help to put into context some of the exposition and discourse that come later in the narrative, especially in the scene that takes place in the operating theatre. For the specific detail of this, there is additional reflection on bringing scientific information into a narrative through dialogue, in the corresponding section above, 'b. Balancing Narrative pace against exposition', for 'The Patient Experiment'.

In passages that demand scientific exposition or a complex discourse and being conveyed through dialogue is the only route for the characters to experience that information—and so in turn, the reader—there was always a hard-fought (self-)editorial process between the demands of the fiction in delivering the narrative effectively, and those of the scientific information and elements of science communication that I wanted to communicate with the reader. I will reflect on such an instance through discussing a passage from my final piece in the collection, the novella, 'A Common Thread'.

Starts with Professor Charles:

> "'Okay. This whole set-up is basically a cutting-edge "gene sequencer". Your left to right we have a DNA microarray for binding and tagging the DNA sample under investigation. Essentially this identifies, fixes and dyes each chemical base such as *Cytosine*—Yes?—with a fluorescent stain.'
>
> The prof looked for confirmation that I understood at least that. 'Yes,' I played along. Interested though.
>
> 'So the raw sample of DNA, obtained from wherever is multiplied in a PCR…'
>
> 'Polymerase Chain Reaction,' I cut in and felt some redress for the earlier exchange.
>
> 'Very good but I assumed you knew that anyway.'
>
> Touché. I smiled.
>
> He nodded. 'So the often minute and possibly damaged sample is aggressively multiplied to create enough material for us geneticists to work with. Once it has gone through the DNA microarray,' he patted the first cube as though it were a child, 'it normally gets passed onto an optical gene or DNA sequencer. However, this second box contains something a bit different, a bit of a breakthrough: A Digitalised Sequencer.'"

And following the professor…

> "'You see for my research, this changes everything and certainly makes my life—briefly our lives—much easier and much more interesting.'
>
> 'How? I don't quite follow.' I was genuinely interested.
>
> 'Up until last year, when I received a PCR prepared sample from a laboratory I would run it through the normal stages of the microarray and the sequencer to end up with a list of genetic code. This would then have to be laboriously assembled into the specific genes. Eventually the subject's entire genome could theoretically be uncovered using this method.'
>
> 'So what does your new box do?'
>
> 'The hardware sequencer organises the three billion or so chromosomal letters in a person's DNA profile and re-assembles them into their specific genes. Once fully working it may well be possible to digitalise the genome—the whole gene structure—of a subject. This data could be used to assemble that genome into an electronic or digital facsimile of the donor.'
>
> I let this sink in for a moment. 'You are saying that these machines could reconstruct a person in digital form, from a sample of DNA?' My head filled with possibilities."
>
> (Fitzgerald, 2018, pp.95-6)

In this exchange, mostly delivered through exposition, interspersed with good-natured but competitive discourse, I looked to set-up and determine the notion of what the mysterious FSS equipment exactly was and what it might be capable of or used for. In establishing this, I offer a range of detailed, challenging concepts for a reader to accept and begin to speculate—along with Judith, who asks the questions a reader may wish to ask—on the possibilities that this technology could open up. Through using 'real-world' contemporary techniques and equipment for gathering and analysing genetic data—my speculative element begins at the point of creating a facsimile, as the research this is currently based on proposes to create generic mugshots only, see Sky News Channel (2014)—I encourage both a credible and believable tone with the scientific information in the narrative. Through creating a positive approach in the use of scientific information—partly through dialogue—in the writing of science-as-fiction, I aim to create fiction that is appealing and accessible across a

wide readership, and not just for those readers interested in science, in all its narrative forms.